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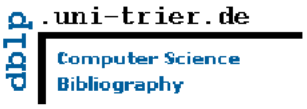
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Keywords- Multimedia; Security; Sensor Networks; Privacy; ECC; Mobile communication; Integrity.

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Emmanuel Ukpe & S.M.F.D Syed Mustapha
School of Information and Communication Technology, Asia e University, Jalan Sultan Sulaiman, Kuala Lumpur, Malaysia

Abstract - In the past decade, the ontology development community has witnessed several platforms and tools for ontology building. All these tools facilitate ontology development processes and direction for the subsequent usage. However, research has shown that current ontology editors do not effectively capture agricultural processes. Existing ontology editors do offer explicit but incomplete agricultural process information. This research proposes the need for a new ontology editor for process capturing, specifically capable of capturing entire cassava plantation process, which can be used to develop Intelligent Tutoring System (ITS) for farmers on crop processing. To this end, this paper examines, analyzes and presents the results of selected ontology editors. The comparison was done using different criteria including an ontology editor's strength, weakness and suitability for capturing entire crop plantation process.

Keywords: Ontology editors, Ontology, Protégé, Apollo, KAON2, SWOOP, WebOnto & Ontolingua

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Mohammad Attallah Sarrayrih, Information Systems and Technology Department, Sur University College, Sur, Sultanate of Oman

Abstract - In this paper, I developed and implemented a web-based Online Exam System application at Sur University College with some additional security features using biometric devices, network protocol and object oriented paradigms to improve online examination systems. I proposed a framework for secured online exams. The proposed application used as a case study at Sur University College for the placement / entrance exams and any other course that offered by the college. Primarily aim to incorporate examination structure comprising of Multimedia questions, Labeling diagrams/maps, Sentence completion, Gap-fill, Multiple-choice questions, True/false/not given statements, Matching headings, Ordering paragraphs, Graph description, Audio/video files. The candidates will enter the answers accordingly and be evaluated automatically by the system. The institution will be able to access the scores and further evaluate the performance of the candidates in accordance with the admission criteria.

Keywords: Online Exam, Offline Exam, Biometrics, IP Address, Packages, University Course, Student Grade, Biometric

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Salaser Babu (1), Zahid Ali Masood (2), Suneel Munir (3), Syed Adnan (4), Irfan Bari (5)
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(2) COMSATS Institute of Information Technology, Islamabad

Abstract - This paper presents the research on OCR (Optical Character Recognition) of English and numerical in noisy printed document images for android mobile. The objective of this paper is to develop an android based solution of current problem and to reduce its complexity to make its implementation lighter and less memory consuming. For this purpose we divided our task into two parts i.e., segmentation and recognition. The innovative feature of proposed approach is that we treated noise and printed text as a separate class. We considered three kinds of noises for testing of system i.e., Salt and Pepper Noise, Monochromatic Uniform Noise and Monochromatic Gaussian Noise. Our developed algorithm can automatically locate the textual regions in the noisy input image. The optical character recognizer then applied to only those regions of the image which contain text. Trained classifier is used to recognize printed text from noise input image. Experimental results show that our approach is robust to light variation and can significantly improve page segmentation and recognition in noisy document collections. Moreover, the proposed approach is the first initiative as there is no such solution available till date which can perform OCR on android mobile remotely.

7. Paper 31121515: A Cloud based GIS Application Framework to Analyse Road Accidents using Windows Azure (pp. 38-44)

Rashid Amin (1, 2), Muhammad Munwar Iqbal (1), Mudassar Hussain (3), Zeeshan Iqbal (1), Naeema Saleem (3)
(1) University of Engineering and Technology, Taxila,
(2) Comsats Institute of Information Technology, Wah Cantt,
(3) University of Wah, Wah Cantt, Pakistan

Abstract — Cloud computing is rapidly evolving technology allowing its users to rent data centre capabilities according to their requirements. It also allows them to instantaneously scale up or scale down the rented capability as per their need. Even not fully evolved, cloud computing can accommodate a wide range of applications and deliver a variety of services. A system which integrates geospatial data with descriptive data is called geographical information system (GIS). Web based application over the cloud are becoming very popular and web based geographical information systems applications are also very useful and in need. This report performs a critical analysis of available and possible use of technology for a project that requires combination of Cloud computing and web based GIS application to achieve its objectives. It also encompasses design and implementation of a cloud based GIS application to analyse road traffic accidents in Cloud Based GIS to Analyse Road Accidents.

Index Terms — Cloud Computing, Geographical Information Systems, Road accident, Windows Azure.

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Barileé Barisi Baridam & Chika Linda Nnamani
Department of Computer Science, University of Port Harcourt, Nigeria

Abstract — Effective transportation involves an efficient and faster connection to a destination. In other to solve the problem of finding the shortest distance in a transportation network, many optimization methods have been applied to transportation system. PSO is one of the recent Bio-inspired optimization methods that are used in solving many optimization problems. There are various methods of solving optimization problem in transportation system which includes the canonical methods, the bio-inspired methods, and other methods. PSO algorithm is applied in various areas including the optimization of a transportation network. Detailed analysis of the basic PSO algorithm is

presented. PSO is used in this work to solve transportation problem (i.e. to optimize the distance) by finding the shortest path in a given transportation network. This PSO algorithm is applied in transportation network with many connections and the shortest distance was found. The procedure includes changing the velocity as well as position by generating a new objective function which is achieved by computing the shortest distance between two points using the Cartesian distance formula. The shortest distance was found considering all the possible routes within the network.

Index Terms — PSO, Optimization, Transportation, Traveling Salesman, Distance metrics, Minimum Spanning Tree.

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Nidal Hassan Hussein, PhD. Program in Computer Science, Sudan University of Science and Technology, Sudan
Ahmed Khalid, Community college, Najran University, KSA

Abstract - Cloud computing is the next generation networks which is soon going to revolutionize the computing world. It has much flexibility like on demand resources and services availability. Security is still critical challenge in the cloud computing paradigm. These challenges include user's secret data loss, data leakage and disclosing of the personal data privacy. In this paper a comprehensive survey of existing literature for cloud computing security challenges and solutions is presented. At the end of this paper the authors propose a model for cloud computing security.

Key words: Cloud computing, cloud computing security, IaaS, PaaS, SaaS

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K. Vijay Bhaskar, Computer Science & Engineering, GITAM University, visakhapatnam, India
Dr. K.Thammi Reddy, Computer Science & Engineering, GITAM University, visakhapatnam, India
S. Sumalatha, Computer Science & Engineering, National Institute of Technology, Warangal, India

Abstract — Graphs are mathematical models of network structures. Graphs are used in an effective manner to represent high dimensional data. Due to increased high dimensional nature of data, we proposed an efficient algorithm to find similarity between the graphs and we show that our approach reduces the search space by effectively pruning the graph data. We also proposed an efficient clustering algorithm for clustering of graphs that uses divisive hierarchical approach.

Keywords-component; Graphs, Edit distance, Graph clustering, Divisive hierarchical.

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Rekha Sugandhi and Anjali Mahajan

Abstract - Behavioral analyses is based on analysis of affects elicited by individuals via modes of body gestures and voice cues. The authors have discussed the roles of such modalities in the study of behavior that indicates presence or absence of depression. The clinical aspects of affect indicators have been taken as reference in the current study. This paper focusses on semantically relating the audio feature vectors to affect that indicate the presence or absence of symptoms of depression in individuals. On the basis of this semantic mapping, the audio feature vectors have been applied on the SVM-RBF kernel to classify the data sets into the appropriate level of depression. On the basis of the classification result, it can be observed that, though not sufficient, the audio features do play a significant role in affect identification and analysis, from comparatively smaller frames of input.

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Masoud Rafighi, Department of Computer Engineering and Information Technology, Qom University, Qom, Iran
Yaghoub Farjami, Department of Computer Engineering and Information Technology, Qom University, Qom, Iran
Nasser Modiri, Department of Computer Engineering and Information Technology, Zanjan Azad University, Zanjan, Iran

Abstract - Various aspects of three proposed architectures for distributed software are examined. A Crucial need to create an ideal model for optimal architecture which meets the needs of the organization for flexibility, extensibility and integration, to fulfill exhaustive performance for potential talents processes and opportunities in the corporations a permanent and ongoing need. The excellence of the proposed architecture is demonstrated by presenting a rigor scenario based proof of adaptively and compatibility of the architecture in cases of merging and varying organizations, where the whole structure of hierarchies is revised.

Keywords: ERP, Data-centric architecture, architecture Component-based, Plug in architecture, distributed systems

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Prachi Rajarapollu, MIT Academy of Engineering, Alandi, Pune, India
Vijay Mankar, Dy. Secretary, M.S. Board of Tech. Education, Pune Regional Office, Pune

Abstract - The standard approach is usually to determine the actual target value as well as discover the hest-focused image location by means of ascending lookup approach. Due to the fact auto-focus algorithm need to be real-time, the standard auto-focus algorithm may have several issues because of growing calculations as number of window region position may vary frequently. A distinct issue will be the frequent interpolation of auto-focus gets slowed because of growing computations. Furthermore, the likelihood associated with de-focusing of target picture may possibly rise as a result of mismatch of the algorithm execution and output of focus. Local-aliasing-sampling approach is apparently utilized to cut back the calculation particularly in HD-dig-cam. Nevertheless, within the Local-aliasing-sampling approach, many precise details may misplace along with raise in noise element. Consequently, the lens deviates through the accurate position and image blur may occur. To overcome this problem, the recommended technique “micro-patch interpolation” quotes each and every lost pixel through a collection of texture-relevant semi-local pixels while using the consistency likeness recurrently calculated from a series of patches of numerous dimensions. Particularly, using iteration, major texture-relevant pixels are employed to develop an information faithfulness expression in an optimum a posteriori evaluation, along with a bilateral complete deviation is employed as the regularization expression. Experimental outcomes weighed against present interpolation approaches prove that our technique can't merely significantly reduce the aliasing issue but additionally develop much better results all over an array of views equally regarding quantitative analysis along with subjective image quality. The presented algorithm can be further used as an API for digital camera image quality enhancement.

14. Paper 31121545: Amalgamation of the Information Security Management System with Business – paradigm shift (pp. 105-111)

Pratima Kushwaha, Information Security Supervisor, Member ISACA

Abstract - In today’s era of a global knowledge-driven economy, ever-changing enterprise risk, cross-organizational functions and the emergence of mobile services, information is a critical asset to an organization’s ability to not only survive, but also to thrive, resulting with information security as a business enabler not solely an information technology discipline. The challenge is to develop & establish an information security program (a governance framework that describes what an effective information security encompasses, how it behaves, and how it relates to

the enterprise and its priorities) and integrating it into business goals, objectives, strategies, and activities. Currently, many enterprises create the policies, procedures, processes, technology strategies, and fail to develop & support a holistic and dynamic approach of information security that is both predictive & proactive (not reactive) as it adapts to change considering the organizational culture and delivering value to the business [1]. This paper describes a governance structure for your organization that provides – context, ownership, support & prioritization to establish & implement a holistic approach/framework to understand the interactions and consequences of information risk & how it relates to overall enterprise risk considering interactions of systems, possible root causes and the best solutions to the problem. It also suggests a feedback mechanism to the current posture of the information security management system at an enterprise level for continual improvement.

15. Paper 31121552: Intensity Correction & Predicting the High Resolution Patches for Super Resolution of Medical Images (pp. 112-117)

Jithin Saji Isaac, Department of Electronics & Telecommunication, Vivekanand Education Society's Institute of Technology, Mumbai, India
Dr. Ramesh Kulkarni, Department of Electronics & Telecommunication, Vivekanand Education Society's Institute of Technology, Mumbai, India

Abstract - Medical images are used to find the existence of certain underlying medical conditions. The increase in the resolution of the image helps to substantially improve the diagnostic capabilities of the medical practitioner and paves the way for automatic detection of the disease. Despite the advancement in medical imaging acquisition devices like Computerized Tomography (CT), Magnetic Resonance Imaging (MRI) etc., the problem of Noise, Blur limits the overall ability of these devices to produce higher resolution images. A solution to this problem is the use of Super Resolution (SR) techniques which can be used for processing of such images. Various methods have been described over the years to generate and form algorithms which can be used for building on this concept of Super resolution. This paper initially deals with the Intensity correction of the Medical images and means to enhance the quality and visibility of intensity inhomogeneous medical images. Later on, the paper explains the work currently done in the field of Super Resolution which includes the famous Sparse based reconstruction method, single & dual dictionary methods, Non local Auto regressive Modelling. The latter part of the paper introduces the statistical prediction method and explains the algorithm developed to enhance the resolution of the image over existing technologies.

Keywords - Intensity Inhomogeneity, Super Resolution, Patch reconstruction, MRI, Sparse Representation

16. Paper 31121516: Intelligent and Dynamic Neighbourhood Entry Lifetime for Position-based Routing Protocol Using Fuzzy Logic Controller (pp. 118-128)

Jafar A. Alzubi, Al-Balqa Applied University, Al-Salt, Jordan
Omar Almomani, The World Islamic Sciences & Education University Amman, Jordan
Omar A. Alzubi, Al-Balqa Applied University, Al-Salt, Jordan
Mahmoud Al-shugran, Jerash University, Jerash, Jordan

Abstract — Mobile Ad-hoc Network (MANET) characterized with high mobility and very limited resources. Such network requires a very high reliable routing protocol to be compatible with its limitations. In position-based routing protocols for MANET, each node chooses the next relay node for packet routing solely from neighbourhood stored in its neighbours' matrix (NLM). The lifetime of neighbors' entry in NLM matrix relates to beacon interval and timeout interval. Inaccurate information of NLM matrix may lead to a wrong selection decision, which can have devastating consequences on MANET resources. Thus, the freshness of the information in a node's NLM matrix is in a high demand. This paper presents an intelligent dynamic fuzzy logic controller refreshment period of entries in neighbourhood matrices (IFPE) scheme. The IFPE algorithm utilizes neighbour's Residual Lifetime of Links (RLT)

in the fuzzy logic controller as an input, and the called neighbor expire entry life-time (ELT) as an output. Simulation results show that IFPE algorithm keeps neighbourhood matrices consistent, which achieve considerable improvement for position-based routing protocols performance.

Index Terms — Networks, Mobile Ad-hoc Network, Position-based Routing, Residual Lifetime of Links, Entry life-time.

17. Paper 31121548: Comparative Analysis of Various National Cyber Security Strategies (pp. 129-136)

Narmeen Shafqat, Dept of Information Security, MCS, National University of Sciences and Technology, Pakistan
Ashraf Masood, Dept of Information Security, MCS, National University of Sciences and Technology, Pakistan

Abstract — The intrinsic vulnerabilities in the cyberspace and ever-escalating cyber-attacks tend to continuously threaten the national security, economy and daily life of citizens. More than fifty countries, around the world, have formulated their Cyber Security Strategies to address the grave concerns of national cyber security. A cyber security strategy is particularly aimed at securing the national cyberspace from malevolent cyber threat vectors, but owing to the varying threat landscape, considerable variations can be seen in the preventive, defensive and offensive measures and approaches adopted by each country. This research paper analyzes and compares National Cyber Security Strategies of twenty countries based on the documented legal, operational, technical and policy-related measures. The majority of the strategies have described the need of appointing an official body for leading the cyber security tasks at the national level and establishment of Computer Emergency Response Teams (CERT/CSIRT) to fight cyber-attacks targeting national cyberspace. However, disparity lies in the understanding of major key terms (particularly cyber security and cyberspace), characterization of the cyber threats, aims and description of cyber awareness and capacity building programs, legislative measures etc. Based on the comparison, the research specifies and recommends best practices for improving the state of national cyber security and resilience. The countries planning to develop or update their cyber security strategies can use this research study to their advantage.

Keywords - Cyber Security Strategy; Critical national infrastructure; Cyber-crimes; Cyberspace security; Incident response team.

18. Paper 31121539: Performance Evaluation of Slant Transform based Gray Image Watermarking against Common Geometric Attacks (pp. 137-146)

Roshan Koju, Department of Electronics and Computer Engineering, Pulchowk Campus, IoE, TU, Lalitpur, Nepal
Prof. Dr. Shashidhar Ram Joshi, Department of Electronics and Computer Engineering, Pulchowk Campus, IoE, TU, Lalitpur, Nepal

Abstract - Performance of slant transform based watermarking technique is evaluated against cropping, rotation and common geometric attacks in this paper. Gray cover image is transformed using lifting wavelet transform and singular value decomposition while watermark image is transformed using slant transform. Cover image is watermarked by replacing singular values of original image by that of slant transformed watermark image. Proposed method is tested with different scaling factor ranging from 0.01 to 0.1 and found to be robust against cropping, rotation and common geometric attacks. This method easily detects and extracts watermark with great accuracy. Method is semi blind and realized in MATLAB.

Keywords— slant transform, geometric attacks, lifting wavelet transform, robustness.

19. Paper 31121540: Development of Products and Services based on Kansei Engineering with Users' Motivation (pp. 147-152)

Ayako Hashizume, Faculty of System Design, Tokyo Metropolitan University 6-6 Asahigaoka, Hino, Tokyo 191-0065, Japan

Abstract - This paper reports on an overview of the motivation from the basic theory, and is discussed its relationship to the use of products and services from the viewpoint of Kansei engineering. User experience is an important concept in the use of products or services, and is classified into pragmatic experience and Kansei experience. The pragmatic experience affected literacy by means of learning, or becoming accustomed to, device operation through the duration or repetition of usage, whereas Kansei experience refers to experience with impression and it increases users' motivation to use products and services. In the usage cycle of products and services, it can be expected not only increase motivation to use them but also serve as the driving force to maintain continuously use.

20. Paper 31121550: Opportunistic diagnosis using Particle Swarm Optimization in Wireless Body Area Network (pp. 153-160)

Mrs Pooja Mohnani, Research Scholar: Jain University, Associate Professor, Department of Telecommunication, CMR Institute Of Technology, Bangalore, India
Dr Fathima Jabeen, Principal, Islamiah Institute of Technology, Bangalore

Abstract —This paper discusses the area of bioinformatics which includes methods for storing, retrieving, organizing and analyzing biological data. Gathering new information from the real time measured data, provides opportunity for preemptive diagnosis & timely action. This may include remote consulting & surgery supervision as enhanced goals. Wireless Body Network is a mesh of various sensors on the body of a human, for measurement of their physiological parameters. WBAN environment, the data is unique, real time & huge. Here, classification system is designed for blood pressure, blood sugar & ECG, that aims to predict healthiness/disorders. For analysis we store the patient's data, apply classification rules on existing data(medical data varies on the basis of age, sex, region, time, position etc.) and layout the best rule based on accuracy(Customization). This medical data is critical as it serves as a primary data and it must be ensured that there is minimal delay in storing, analyzing & classifying it as normal & abnormal efficiently.

Keywords- medical data, Sensor, Classification, WBAN, PSO

21. Paper 31121551: Face Recognition using an HD PTZ Camera in a Virtual Classroom (pp. 161-165)

Ms. Madhavi Vikram, Amrita Centre for Wireless Networks and Applications, Amrita Vishwa Vidyapeetham, Amritapuri ,Kollam, India
Prof. Balaji Hariharan, Amrita Centre for Wireless Networks and Applications, Amrita Vishwa Vidyapeetham, Amritapuri, Kollam, India

Abstract — Advancement in the technology has paved path for a new educational nomenclature, i.e., 'Virtual Classroom'. Virtual Classroom is a teaching-learning environment like the traditional classrooms but offers a wide range of learning flexibility in the virtual environments when compared to traditional education systems. The main hitch in the existing systems is the lack of proper interaction between the students and the teacher. Therefore, this research work focuses on detecting the students in the classroom, recognizing the face of the student who has raised hand for a doubt, and displaying the details of the student such as student name and student id of that particular student. An High Definition Pan-Tilt-Zoom Camera is used to monitor the students and capture their images. The Virtual Classroom specific system makes use of the popular Viola-Jones algorithm for real time Face Detection, Hand-raise Gesture Detection and face of the hand raised student is extracted using image segmentation and morphological operation, followed by point feature extraction and finally Face Recognition is done using Eigen Faces. Thus, the virtual learning environments through proper Face Recognition with special attention to students' needs or queries are an important aspect for a better learned society.

Keywords - Face Detection, Face Recognition, Hand-raise Gesture Detection, Virtual Classroom

Naïve Bayes and J48 Classification Algorithms on Swahili Tweets: Perfomance Evaluation

Hassan Seif
College of Informatics and Virtual Education
University of Dodoma
Dodoma, Tanzania

***Abstract*—The use of social media has grown significantly due to evolution of web 2.0 technologies. People can share the ideas, comments and posting any events. Twitter is among of those social media sites. It contains very short message created by registered users. Twitter has played the important parts in many events by sharing message posted by registered user. This study aims on evaluating performance of Naïve Bayes and J48 Classification algorithms on Swahili tweets. Swahili is among of the African language that is growing faster and is receiving a wide attention in web usage through social networks, blogs, portals etc. To the best of the researcher's knowledge; many studies have been conducted on other language for comparing classification algorithms, but no similar studies found on Swahili language. The data of this study was collected from the top ten most popular twitter accounts in Tanzania using Nodexl. These accounts were identified according to the number of followers. The extracted data were pre-processed in order to remove noise, incomplete data, outlier, inconsistent data, symbols etc. Further, the tweets contains words which are not in Swahili language were identified and removed and filtered by removing url links and twitter user names. The pre-processed data analysed on WEKA using Naïve Bayes and J48 classification algorithms. The algorithm then evaluated based on their accuracy, precision, recall and Receiver Operator Characteristic (ROC). It has been found that; Naïve Bayes classification algorithms perform better on Swahili tweets compared to J48 classification algorithm.**

Keywords-Social media; Swahili tweets; Naïve Bayes; J48

I. INTRODUCTION

Due to the evolution of web 2.0 technologies, now days the use of social media sites has grown significantly. People communicate, posting their comments and views through social media sites depending on their interest/opinions. It is estimated that there are over 900 social media sites on the internet with more popular platforms like Facebook, Twitter, LinkedIn, Google Plus, and YouTube [1].

Twitter is a popular and massive social networking site which has a large number of very short messages created by the registered users. It is estimated that; there are about more than 140 million active users who publish over 400 million 140-character "Tweets" every day [2]. The large speed and ease of publication of Twitter have made it as an important communication medium for people. Twitter has played a prominent role in socio-political events and also has been used to post damage reports and disaster preparedness information during large natural disasters, such as the Hurricane Sandy [2].

The data posted on twitter can be used for various research purposes. In context of data mining, there are two fundamental tasks that can be considered in conjunction with Twitter data: (a) graph mining based on analysis of the links amongst messages, and (b) text mining based on analysis of the messages' actual text [3]. Twitter graph mining based on analysis of the links amongst message can be applied in measuring user influence and dynamics of popularity, community discovery and formation and social information diffusion. On twitter text mining based on analysis of actual message, the number of task which can be performed includes; sentiment analysis, classification of tweets into categories, clustering of tweets and trending topic detection [3], this study is based on classification of tweets into categories; where by algorithms used was to be compared.

Swahili is among of the African language that is growing faster and is receiving a wide attention in web usage through social networks, blogs, portals etc. It is spoken in several countries found in Africa such as; Tanzania, Kenya, Uganda, Burundi, DRC Congo, Rwanda, Mozambique and Somalia; and has about 50 million speakers. There are four categories of African languages namely: Khoisan, Afro-Asiatic, Nilo-Saharan and Niger–Congo Kordofanian. Swahili belongs to the Niger- Congo group of languages specifically the Sabaki subgroup of Northeastern Coast Bantu languages [4].

To the best of the researcher's knowledge several studies has been conducted for comparing classification algorithms, but many of them are based in English and other languages. There are no similar studies on Swahili language. Furthermore, there are no set of corpus of Swahili tweets which are ready made publicity available for research purpose. For this reason it can be stated that, Swahili is among of the under-resourced language. The term "under-resourced language" refers to a language with some of (if not all) the following aspects: lack of a unique writing system or stable orthography, limited presence on the web, lack of linguistic expertise, lack of electronic resources for speech and language processing, such as monolingual corpora, bilingual electronic dictionaries, transcribed speech data, pronunciation dictionaries, vocabulary lists, etc [5].

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This study is intended to compare the performance of Naïve Bayes and J48 Classification algorithm on Swahili tweets.

II. NAÏVE BAYES

Naïve Bayes is a simple classifier based on the Bayes theorem. It is a statistical classifier which performs probabilistic prediction. The classifier works by assuming that; the attribute are conditionally independent.

For Naïve Bayes classification, the following equation is used [6] ;

$$P(Ci|X) = \frac{P(X|Ci)P(Ci)}{P(X)} \quad (1)$$

From equation (1) above, the classifier, or simple Bayesian classifier, work as follows;

(1) Let D be a training set of tuples and their associated class labels. Each tuple is represented by an n-dimensional attribute vector, X= (X1, X2....., Xn) , depicting n measurements made on the tuple from n attributes, respectively, A1, A2....., An .

(2) Suppose that there are m classes, C1, C2.....Cm . Given a tuple, X, the classifier will predict that X belongs to the class having the highest posterior probability, conditioned on X. That is, the Naïve Bayesian classifier predicts that tuple X belongs to the class *Ci* if and only if $P(Ci \mid X) > P(Cj \mid X)$ for $1 \leq j \leq m; j \neq 1$. Thus we maximize $P(Ci \mid X)$. The class *Ci* for which $P(Ci \mid X)$ is maximized is called the maximum posteriori hypothesis.

(3) From equation (1), as P(X) is constant for all classes, only $P(X \mid Ci)P(Ci)$ need be maximized. Then predicts data item X belongs to class *Ci* if and only if has got the highest probability compared to other class label.

III. J48

J48 is one of the decision tree induction algorithm .It is an open source Java implementation of the C4.5 algorithm in the WEKA data mining tool [7]. This algorithm was developed by Ross Quinlan. C4.5 algorithm creates a decision tree which can be used for classification based the value which are presented on dataset. The following steps are used while the decision tree is constructed on J48 classification algorithm;

(1) In general the tree is constructed in a top-down recursive divide-and-conquer manner, at start, all the training examples are at the root, attributes are categorical (if continuous-valued, they are discretized in advance), examples are partitioned recursively based on selected attributes test attributes are selected on the basis of a heuristic or statistical measure (e.g., information gain)

(2) Conditions for stopping partitioning are as follows; all samples for a given node belong to the same class, there are no remaining attributes for further partitioning – majority voting is employed for classifying the leaf, there are no samples left.

IV. RELATED WORKS

A review of literature from various scholars reveals that there are number of studies which were conducted for comparing several classification algorithms.

Goyal, A and Mehta, R [8] conduct a study on comparative evaluation of Naïve Bayes and J48 classification algorithms. The study was in the context of financial institute dataset with the aim of checking accuracy and cost analysis of these algorithms by maximizing true positive rate and minimizing false positive rate of defaulters using WEKA tool. The result showed that; the efficiency and accuracy of J48 and Naive Bayes is good [8].

Another study was conducted by Arora, R and Suman [9] which check comparative analysis on classification algorithms on different datasets using WEKA. The comparison was conducted on two algorithms; J48 and Multilayer Perceptron (MLP). The performance of these algorithms have been analysed so as to choose the better algorithm based on the conditions of the datasets. J48 is based on C4.5 decision based learning and MLP algorithm uses the multilayer feed forward neural network approach for classification of datasets. It has been found that; MLP has better performance than J48 algorithm.

Patil, Tina R and Sherekar, S S [10] did the study on comparing performance of J48 and Naïve Bayes classification algorithm based on bank dataset to maximize true positive rate and minimize false positive rate of defaulters rather than achieving only higher classification accuracy using WEKA tool. The study found that; the efficiency and accuracy of J48 is better than that of Naïve Bayes.

Furthermore a comparative analysis of classification algorithms for students' college enrollment approval using data mining had been conducted using dataset from King Abdulaziz University database. In this study; the WEKA knowledge analysis tool is used for simulation of practical measurements. The classification technique that has the potential to significantly improve the performance is suggested for use in colleges' admission and enrollment applications. It has been found that; C4.5, PART and Random Forest algorithms give the highest performance and accuracy with lowest errors while IBK-E and IBK-M algorithms give high errors and low accuracy [11].

V. METHODOLOGY

A. Data Set Collection

The dataset of this study was collected from the top ten most popular twitter accounts in Tanzania using Nodexl. These accounts were identified according to their number of followers as presented in socialbakers sites [12]. Hot topics with their comments were identified and extracted using Nodexl

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software. The collected data were stored in a CSV format for easy to be analysed in WEKA software.

B. Data Preprocessing

This is one of the most important steps in data mining. Since no quality data, no quality mining result. Some of data preprocessing techniques are data cleaning, data integration, data transformation, data reduction and data discretization [6]. These techniques may be combined together as a stage of data preprocessing.

The data of this study were cleaned in order to remove noise data, incomplete data, outlier, inconsistent data, symbols etc. Also, the tweets contains words which are not in Swahili language were identified. The words further are filtered by removing url links, and twitter user names. Finally the words/tweets which are not in Swahili language were removed this is because there are some tweets which was found to be in mixed language (Swahili and English) and other in English only.

C. Data Analysis

The pre-processed data were analysed by using WEKA software. "WEKA" stands for the Waikato Environment for Knowledge Analysis, which was developed by the University of Waikato in New Zealand. It is open source software issued under the GNU General Public License. WEKA has a collection of machine learning algorithms for data mining task. It has techniques for data pre-processing, classification, regression, clustering, association rules, visualization etc. It is written in Java and runs on almost every platform. It is also well-suited for developing new machine learning schemes. The tool gathers a comprehensive set of data pre-processing tools, learning algorithms and evaluation methods, graphical user interfaces (incl. data visualization) and environment for comparing learning algorithms. WEKA is easy to use and to be applied at several different levels.

WEKA has been selected because the Naïve Bayes and J48 Classification algorithm are implemented in this tool. This would results in achieving the objective of the study which is to compare the performance of Naïve Bayes and J48 classification algorithm on Swahili tweets.

D. Model Evaluation

After analyzing the data on WEKA, each algorithm was compared on their performance. Performance evaluations were based on recall, precision, accuracy and ROC curve. The formula used for evaluating these algorithms based on the following confusion matrix as described in Table 1 ;

Table 1: Confussion Matrix

		Detected	
		Positive	Negative
Actual	Positive	A:True Positive	B:False Negative
	Negative	C:False Positive	D: True Negative

Recall/Sensitivity/True positive rate it is the proportion of positive cases that were correctly identified. Recall can be calculated using the following equation:

$$\text{Recall} = \frac{A}{A + B} \quad (2)$$

Precision/Confidence denotes the proportion of Predicted Positive cases that are correctly Real Positives. Equation (3) can be used in finding precision;

$$\text{Precision} = \frac{A}{A+C} \quad (3)$$

Accuracy of a classifier on a given test set is the percentage of test set tuples that are correctly classified by the classifier. The true positives, true negatives, false positives, and false negatives are also useful in assessing the costs and benefits (or risks and gains) associated with a classification model [6]. The following equation can be used to calculate the accuracy of the classifier;

$$\text{Accuracy} = \frac{A + D}{A + B + C + D} \quad (4)$$

Receiver Operator Characteristic (ROC) curve is a graphical method for displaying the tradeoff between true positive rate and false positive rate of a classifier. True positive is plotted along the Y-axis and false positive is plotted along the X-axis. The ROC has got number of properties depending on the value of its area under the curve. The following describe the nature of prediction/classification based on the value of ROC curve area (A);

A= 1.0: perfect prediction
A= 0.9: excellent prediction
A= 0.8: good prediction
A= 0.7: mediocre prediction
A= 0.6: poor prediction
A= 0.5: random prediction
A= <0.5: something wrong

VI. RESULT AND DISCUSSION

Experiments were performed on Swahili tweets data set which was extracted by using Nodexl. The total number tweets on a data set were 276 with 5 attributes. These data analysed on WEKA tool by using Naïve Bayes and J48 Classification algorithm. Before the data set tested on classification algorithm, attribute subset selection measure were used in order to select the best attribute and removing all weak irrelevant attribute. Since the high dimension data will make testing and training of general classification methods to be difficult [13]. The Heuristic method used was stepwise forward selection (Best First) whereby the best of the original attribute is determined by added to the reduced set of attribute.

The accuracy of the selected algorithms (J48 and Naïve Bayes) was tested by cross validation method. In this method, 10-fold cross validation was used where by a data set were

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randomly partitioned into 10 mutually exclusive folds each of approximately equal size. Training and testing is performed 10 times. For each iteration, one fold is selected as the test set and the remaining data in another nine folds used as a training set. The testing is repeated 10 times. The final accuracy of an algorithm will be the average of the 10 trials.

Table 2 shows the result of the experiment on Swahili tweets using Naïve Bayes and J48 classification algorithms on WEKA

Table 2: Experiment Results

Evaluation / Algorithm	Accuracy	Precision	Recall	ROC
Naïve Bayes	36.96%	0.294	0.37	0.525
J48	34.78%	0.121	0.348	0.461

It has been found that; Naïve Bayes classification algorithms perform better on Swahili tweets compared to J48 classification algorithm. The model were evaluated by using accuracy, precision, recall, and ROC; and it has been found that, Naïve Bayes has the highest accuracy (36.96%) compared to J48 classification algorithm (34.78%). This implies that; the total number of instances that are correctly classified by Naïve Bayes is larger than the total number of instances that are correctly classified by J48. Furthermore; Naïve Bayes has been found to be the best in terms Precision (0.294), Recall (0.37) and ROC (0.525) compared to J48 in terms of Precision (0.121), Recall (0.348) and ROC (0.461).

VII. CONCLUSION

The Naïve Bayes has been found to be the best classification algorithm on Swahili tweets data set compared to J48 classification algorithm in terms of accuracy, precision, recall and ROC. In general the performance of Naïve Bayes and J48 algorithm on Swahili tweets was very poor. This is because; the values of their evaluation measure (accuracy, precision, recall, and ROC) are very small.

More research should be conducted in order to identify the best algorithm which will give highest performance in terms of accuracy, precision, recall, ROC and other evaluation measures. Further research also should be conducted in order to find the way on how to increase the performance of both algorithm (Naïve Bayes and J48) in terms of accuracy, precision, recall, ROC and other evaluation methods.

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A Practical Approach to Creation and Analysis of FSM Designs

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***Abstract*—It is a common task for register-transfer level (RTL) design developers to design a finite-state machine (FSM). To design a complete and correct FSM design, it requires a lot of development and validation effort. To reduce the product development cycles and improve design quality, it is highly desired to have a systematic approach to development and validation of FSM designs. In this paper, we present a practical framework to support FSM design creation and analysis. First, a FSM design GUI is provided for developers to create the FSM and the created FSM is further converted into Verilog. Then the converted RTL design is analyzed using symbolic execution to generate efficient test cases to cover all possible states. Furthermore, the generated test cases are applied to RTL designs to compute the coverage. We have applied this framework to several FSM designs. The experimental results show that our approach is useful and efficient.**

***Index Terms*—RTL Design, Finite-state Machine, Creation and Analysis of FSM Design, Symbolic Execution, Test Case Generation, RTL Simulation**

I. Introduction

In the past several decades, Register-transfer level (RTL) hardware description languages have been widely used for implementing different kinds of electronic circuits [1]. Since the behavior of finite-state machines (FSMs) can be observed in many hardware circuits, it is very common to design and implement FSMs using RTL language [2]. Therefore, hardware circuit developers need to spend a lot of effort and time on designing, implementing and validating FSM designs using RTL language. It is greatly desired that there is an innovative approach to shorten the time and reduce the effort to create, analysis and validation of FSM designs.

To design a complete and correct FSM design, it requires a lot of schedulability analysis [3], development and validation effort. Nowadays, it is highly critical to reduce time-to-market and development cost to increase product competitiveness. To reduce the product development cycles and improve design quality, it is highly desired to have a systematic approach to development and validation of FSM designs.

The traditional approach to design a FSM using RTL language is to write the RTL code to implement all functionalities. Because it is easy for developers to make mistakes, it is difficult to easily observe if a FSM is implemented correctly. Sometimes hardware developers implement the FSM as a state diagram and then manually create RTL code according to the state diagram. It is better that there is a tool which can convert a state diagram into RTL code automatically. Some developers have implemented Fizzim [4] which is an open-source, graphical FSM design environment. In our approach, we have employed Fizzim as our FSM design GUI.

To analyze a RTL design, a common approach is to write a test bench and design some test cases. For analyzing a FSM design, it is desired to implement sufficient test cases to cover all possible states and state transitions. Recently symbolic execution techniques have been borrowed from software domain and applied to hardware domain [5], [6]. Symbolic execution of RTL designs have been explored to analyze RTL implementations [7]–[9]. In our approach, we have developed a RTL symbolic execution engine to generate test cases. The generated test cases are applied to RTL simulation for design analysis.

In this paper, we present a practical framework to support automatic FSM design creation and analysis. First, a FSM design GUI is provided for developers to create the FSM and the created FSM is saved as a XML file. The corresponding Verilog implementation, a symbolic execution harness and a simulation test bench are generated by parsing the XML file. Then the converted RTL design and the test harness are analyzed using a symbolic execution engine to generate efficient test cases to cover all possible states. Furthermore, the generated test cases are applied to RTL designs and the simulation is guided by the test bench. In the RTL simulation, the generated test cases are used for exploring as many states as possible and achieving the high simulation coverage. We have applied this framework to several FSM designs. The experimental results show that our framework can be very useful for implementing FSM designs and analyzing the corresponding RTL designs.

The remainder of this paper is structured as follows. Section 2 provides the background. Section 3 presents the framework. Section 4 discusses the experimental results. Section 5 concludes and discusses future work.

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II. Background

A. A FSM Design Example

A FSM is a computational model which is used for modeling both hardware and certain software programs [10]. For designing electronic circuits, FSMs are widely used as the reference and implementation models. It is very common for electronic circuit designers to design and implement FSMs for developing an electronic circuit.

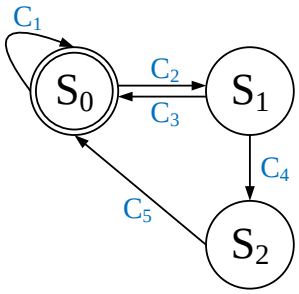

Fig. 1: A FSM example

To better introduce a FSM, we give an example shown in Figure 1. In this figure, a FSM diagram is shown. In this FSM, there are three states: S_0, S_1 and S_2 where S_0 is the reset state. There are five state transitions: $S_0 \xrightarrow{C_1} S_0$, $S_0 \xrightarrow{C_2} S_1$, $S_1 \xrightarrow{C_3} S_0$, $S_1 \xrightarrow{C_4} S_2$ and $S_2 \xrightarrow{C_5} S_0$ where C_1, C_2, C_3, C_4 and C_5 are the corresponding state transition conditions.

If the FSM shown in Figure 1 represents the logic of an electronic circuit, each state transition must be triggered by an execution cycle. Suppose the hardware state is S_1 at some cycle, the next state can be S_0 or S_2 depending on the hardware inputs. Sometimes the state transition condition can be empty. For example, C_5 is empty which means that whatever the inputs are, it is always true that the current hardware state is S_2 and the next hardware state is S_0. The state transition $S_2 \xrightarrow{C_5} S_0$ happens every execution cycle and the transition condition C_5 is empty.

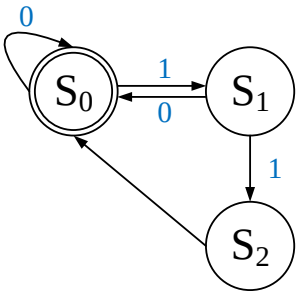

Fig. 2: A refined FSM example

Suppose the inputs can be only 0 or 1, we refine the state diagram in Figure 1 as Figure 2. There are still 3 states and 5 state transitions. The state transition $S_2 \rightarrow S_0$ is a unconditional state transition. The other state transitions depend on the hardware inputs.

B. Symbolic Execution of FSM Designs

Symbolic execution is a technique of exploring a program by symbolically executing a program [11], [12]. There have been many tools developed and approaches explored for symbolic execution [13]–[22]. Here we use an example to better demonstrate the idea of symbolic execution.

```
1   int test(int x) {
2       if (x > 10)
3           return x - 1;
4       else if (x < 0)
5           return x + 1;
6       else
7           return x;
8   }
```

Fig. 3: A sample program

As shown in Figure 3, the function $test$ takes an integer x as inputs and return an integer. The execution flow of the program is shown in Figure 4. If we make the input x as a symbolic variable and execute the function $test$ symbolically, the symbolic execution engine explores all three paths automatically. For each explored path, a test case is generated. In this way, all paths of the function are covered.

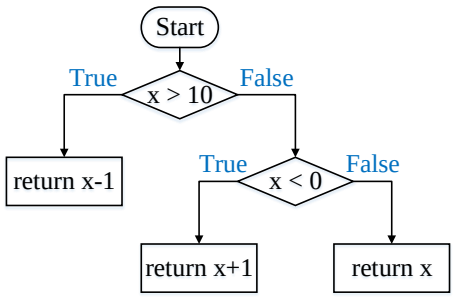

Fig. 4: The execution flow of the sample program

Recently symbolic execution has been widely used in hardware domain. Symbolic execution of RTL designs have been used for generating efficient test cases for RTL validation [7], [23] and checking equivalence for high-level synthesis [8]. Symbolic execution of virtual prototypes have been used for test case generation [24], [25], conformance checking [26] for post-silicon functional validation. Symbolic execution of firmware code have been used for detecting firmware security vulnerabilities [27], [28].

In this paper, we also employ symbolic execution to explore all possible states and state transitions in a FSM design. For the FSM shown in Figure 1, we want to utilize symbolic execution to generate sufficient test cases. The generated test cases should cover all 3 states and 5 state transitions.

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III. Design and Implementation

A. Overview

It is important to provide a way for RTL developers to design, implement and analyze FSM designs systematically. A systematic and reasonable approach can significantly shorten development time and reduce design cost. In this paper, we propose a systematic approach to creation and analysis of FSM designs. The purpose of our idea is to provide a more convenient and practical methodology for accelerating FSM development and validation.

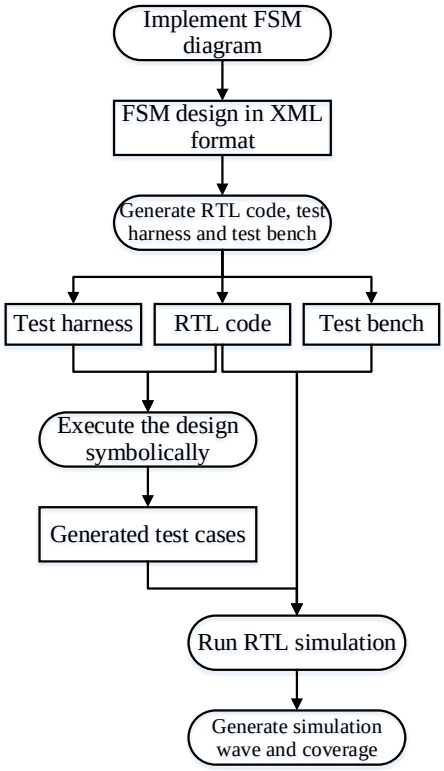

Fig. 5: The workflow of our framework

As shown in Figure 5, the workflow mainly include four steps:

- *Implement FSM diagrams.* The first step of our approach is to implement a FSM as a diagram. It is very common for FSM developers to implement as a FSM as a diagram since a FSM diagram is very easy to understand. In our approach, we provide a FSM design GUI for developers to design and draw a FSM diagram. The FSM diagram is further saved as a XML file.
- *Generate RTL code, test harness and simulation bench.* By parsing the FSM XML file, our framework automatically generates three kinds of outputs. First, a RTL design is generated based on the FSM logic. Second, a test harness is generated for guiding symbolic execution. Third, a test bench is generated for RTL simulation.
- *Execute the RTL design symbolically.* We employ a symbolic execution engine to execute the generated RTL design. The symbolic execution is guided by the generated test harness. The symbolic execution engine explores as many possible states and state transitions as possible and generates test cases.
- *Run RTL simulation.* We employ a RTL simulation tool to simulate RTL design. The generated test bench reads the generated test cases and guide the simulation. In the end, the developers can check the simulation waves and coverage reports.

B. FSM Diagram Design

In our approach, we employ a tool Fizzim [4] as the FSM diagram design GUI. With Fizzim, developers can easily design a FSM diagram for implementing hardware circuit logic. We implement the example shown in Figure 2 using Fizzsim as a FSM diagram shown in Figure 6.

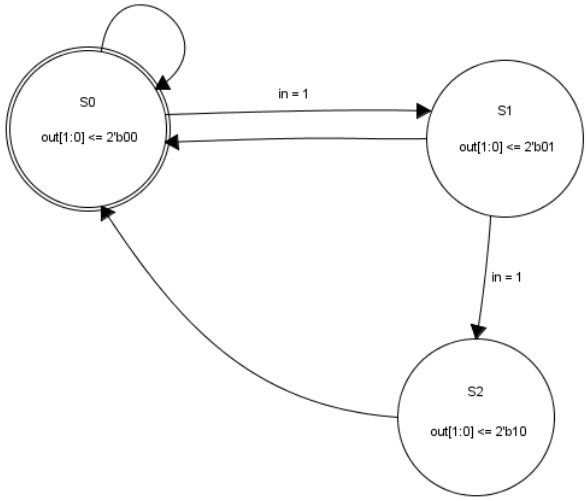

Fig. 6: A Fizzim FSM example

As shown in Figure 6, there are three states S_0, S_1, S_2 and five state transitions. The reset state is S_0 There is one input variable in. To better demonstrate our idea, we added a output variable out in this design. Moreover, there is a reset input which is used for resetting the state to S_0. More details will be illustrated in code generation section.

For this design, the input in can be only 0 or 1. Therefore, we only label the $in = 1$ transition conditions in this diagram. For the other transition conditions, it uses all possibilities. For example, the condition for the transition S_1 to S_0 is $in = 0$ since if the input $in = 1$, the next state is S_2. Some state transitions are unconditional. For example, the transition from S_2 to S_0 is unconditional. If the current state is S_2, the next state is always S_0 whatever the input in is. The generated FSM diagram is saved as an XML file for further parsing.

C. Code Generation

By parsing the XML file, the corresponding RTL code is generated to represent the FSM design. Moreover, a test harness is generated for guiding symbolic execution and a simulation harness is generated for guiding RTL simulation.

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To better demonstrate the idea, we show the generated RTL code in Figure 7. In this design, there are three inputs clk, in, rst_n and one output out. The generated RTL code exactly follows the logic defined in the diagram shown in Figure 6. There are 3 states and 5 state transitions. When there is a reset signal enabled, the state is reset to S_0. Depending on different inputs and current states, the state is transitioned from one to another. The output of this RTL design is saved in out which represents the state index.

```
module example (
  output wire [1:0] out,
  input wire clk,
  input wire in,
  input wire rst_n
);

// state bits
parameter
S0 = 2'b00, // out[1:0]=00
S1 = 2'b01, // out[1:0]=01
S2 = 2'b10; // out[1:0]=10

reg [1:0] state;
reg [1:0] nextstate;

// comb always block
always @* begin
  nextstate = state;
  case (state)
    S0: begin
      if (in = 1) begin
        nextstate = S1;
      end
      else begin
        nextstate = S0;
      end
    end
    S1: begin
      if (in = 1) begin
        nextstate = S2;
      end
      else begin
        nextstate = S0;
      end
    end
    S2: begin
      begin
        nextstate = S0;
      end
    end
  endcase
end

// Assign reg'd outputs to state bits
assign out[1:0] = state[1:0];

// sequential always block
always @(posedge clk or negedge rst_n) begin
  if (!rst_n)
    state <= S0;
  else
    state <= nextstate;
end

endmodule
```

Fig. 7: A generated RTL code example

D. Symbolic Execution

We developed a symbolic execution engine for executing the RTL code. It takes the RTL design and the test harness as inputs. Then it executes the design following the logic defined in the test harness. Since the FSM designs usually follow a common way to reset, we reset the RTL design in the first cycle in the symbolic execution. In the following cycles, we disable the reset signal and make the input variable in symbolic using a special function $make\_symbolic$.

In order to cover all states and state transitions, it is necessary to define how many cycles should be executed in the symbolic execution. Currently, the number of cycles we used is the number of states plus one. In this way, it is true that all possible states and state transitions are covered.

For each explored path, the symbolic execution engine generates a test case. A test case is a sequence of inputs which can trigger the desired sequence of state transitions. The generated test cases are further applied to RTL simulation for observing state transitions and computing coverage.

IV. Preliminary Evaluation

A. Experimental Setup

To evaluate our approach, we have applied this framework to several examples provided by Fizzim. These examples include $5state\_iloop, cliff, flags, comments$ and $params$. We have conducted all experiments on a machine with i7 CPU and 4GB memory.

B. Test Case Generation and Time Usage

After executing five designs using symbolic execution, quite some test cases are generated. We summarized the number of generated test cases, time usage and memory usage in Table I.

TABLE I: Summary of Test Cases and Time Usage

	# of Test Cases	Time (seconds)	Memory (MB)
5state_iloop	64	8	45
cliff	256	31	53
flags	64	87	49
comments	64	5	45
params	274	13	49

As shown in Table I, our approach can generate many test cases in a short time with low memory usage. Currently we have only applied our approach to some small designs, therefore hundreds of test cases are sufficient to cover all possible states.

For all five designs, the test cases generated can cover all possible states and RTL statements. However, it does not mean that all simulation coverage is 100%. There are some dead states. For example, there is an ERROR state in the design $5state\_iloop$. An excerpt of the design diagram is shown in Figure 8.

There is no transitions to the ERROR state. Therefore, our approach can not generate a test case covering the ERROR state. If there is no dead states in a design, our approach can cover all possible states.

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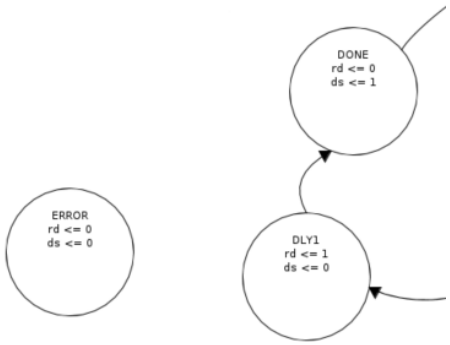

Fig. 8: An excerpt of $5state\_iloop$ design

C. RTL Simulation

The test bench applied all generated test cases to RTL design. We employed Mentor Graphics ModelSim [29] as our RTL simulation tool. With the simulation tool, it is easy for engineers to observe and validate all signals. One sample RTL simulation wave is shown in Figure 9.

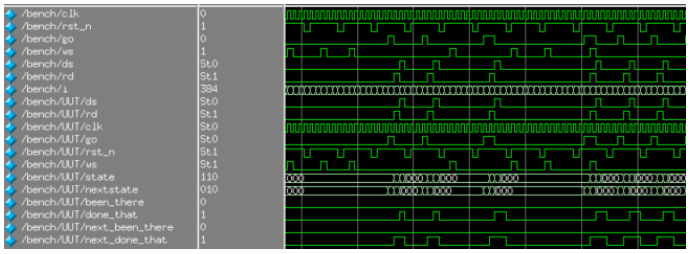

Fig. 9: RTL simulation wave

To further compute the coverage, the simulation tool provides two ways. One is HTML outputs shown in Figure 10. With the HTML coverage outputs, the developers can easily check which statements are not covered and further figure out the reasons.

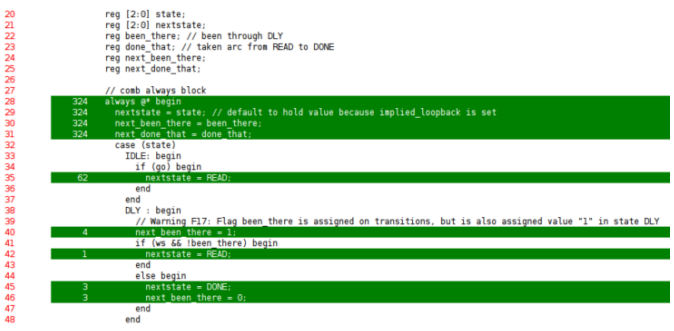

Fig. 10: RTL simulation coverage

V. Conclusion

In this paper, we present a systematic approach to creation and analysis of FSM designs. A FSM design GUI is used for implementing a FSM design and save the final result as an XML file. Then the XML file is parsed and further RTL code, analysis harness and simulation bench is generated. A symbolic execution engine has been developed for executing the RTL code symbolically and generating test cases covering all possible states. The generated test cases have been applied to RTL simulation successfully. We have applied our approach to several practical FSM designs. In the future, we will explore how to apply our approach to larger designs.

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A Secured Wireless Multimedia Sensor Network

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Abstract — **Wireless Multimedia Sensor Networks (WMSNs) are considered an extension to traditional scalar wireless sensor networks, as they are able to support the acquisition and the delivery of multimedia content, such as audio, images and video. This work proposes and develops a customizable framework able to protect, monitor, and keep field applications safe. Field applications require complex high-throughput security elements that cannot be addressed by traditional perimeter security solutions. A streaming video solution of WMSNs is designed in a cross–layer fashion and consists essentially of a hybrid DPCM encoder, a congestion control mechanism and a selective priority automatic request mechanism at the MAC layer. This framework has been implemented on the Mica2 mote hardware platform operated by TinyOs operating system and was evaluated through test-bed simulation and experiments to be evaluated for different frame sizes and numbers of nodes. This system is secured by a combination of video data aggregation and location protocols of WMSNs.**

Keywords- Multimedia; Security; Sensor Networks; Privacy; ECC; Mobile communication; Integrity.

I. INTRODUCTION

Wireless Multimedia Sensor Networks (WMSNs) were developed so that the networks of wireless devices would be able to sense multimedia content. This development was carried out with the help of integrating low-power wireless networking technologies such as Wireless Sensor Network (WSN) with inexpensive hydrological sensors for the purpose of affordable and reliable threat monitoring. WMSNs may enable new applications ranging from enhanced surveillance and monitoring systems to advanced services for health care and assisted living environments, as WMSNs can be integrated with real-time localization systems. WMSNs are extremely different from traditional sensor networks which are constrained in terms of battery, memory and computational capability and the applications of multimedia sensor networks which require real-time data from camera network struggle with the network side limitations and with the constraints imposed by the limited energy resources and processing capabilities of available embedded processors for sensor nodes. Regarding the development of WMSNs, several valuable surveys have tackled this issue with respect to application scenarios, existing solutions and open research issues at the different layers of the communication stack, cross-layer optimizations and streaming mechanisms.

A video streaming system for wireless multimedia sensor networks is presented in this paper. It features a framework for multimedia delivery built on top of a multi-hop wireless sensor network in order to provide secure and authenticated surveillance video. Moreover a hybrid DPCM coding scheme is integrated in order to achieve high compression while maintaining perceptual video quality and a multi-hop congestion control system has also been integrated to minimize latency due to buffer overflows in intermediate nodes.

This system is implemented using the Mica2 mote hardware platform with a IMB400 multimedia sensor board. The system software is written in nesC language, the application language used in TinyOs environment [1].

The rest of the paper is organized as follows: In section II, we provide some background on video streaming used in WMSN. In section III and IV, the solution is described in details. In section V, the proposed system will be evaluated through simulation and finally in section VI, the paper is concluded and recommendations for future research are given.

II. RELATED WORK

Wireless multimedia sensor networks have received much attention recently as they offer precise localization information employed on high quality video images. Several efforts have been made to achieve important results in various fields related to WMSN, from the research as specialized hardware to the development of efficient algorithms and protocols for multimedia transmission. Image transmission over low bit rate networks such as wireless LAN and Zigbee networks is addressed in [2], as both JPEG and H.264 compression schemes will be tested, limitations of the network are highlighted and both peak-signal-to-Noise ratio (PSNR) and the average decodable frame rate will be evaluated. In [3], simple single hop network architecture is described. It enables to acquire, compress and send to a base node pre-processed images relying on a compression technique that is very similar to JPEG coding. As for video transmission, it is more concerned with the transport of multimedia streams across WSNs and it introduces a flow–control mechanism that is based on pipelined transmission MAC in order to secure the gas pipelines and other government constructions located in such desert areas.

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Increasing network performance in similar application network cross–layer approach is proposed in [4]. It aims at tuning the rate of video transmissions to minimize distortion caused by desert dust and climate change and in order to achieve fairness among multiple concurrent video flows in multi-hop WSNs.

In [5], Kim et al. proposed a real-time video surveillance system that was composed of two cameras and multiple low-cost wireless sensors in architecture. Hence, the sensor network would detect and trace an object and wake up the surrounded by cameras to record those events. As for Zhang et al. they proposed a scheduling technique in [6] to transmit video packets over multiple priority paths according to their degree of importance, where high priority packets are preferred over low-priority packets when transmitted over high bandwidth paths. This mechanism provides a power aware packet scheduling that is able to identify the available paths and drops the least significant video packets selectively prior to transmission in order to save energy. In [7], Guo and Little design a QoS-enabled dynamic path formation algorithm that yielded to a dynamic path of video delivery over WSNs through by distributing a limited number of mobile nodes to the location of each video stream on the network. In [8], a multi-path multi source video on-demand streaming has been applied in WMSNs with great success. As a video sequence is encoded in multiple streams and each of them is assigned to a different path to ensure the sensed video data to be delivered reliably and timely. Therefore, when the packets pass across the multi-hop network, they get partially and progressively decoded through a distributed error recovery framework. Ultimately, [9] described a multi-channel access method for video forwarding in wireless sensor network, where time slot assignment is employed in the transmission of constrained video feeds and the time slot assignment is self-determined based on routing information. The practical implementation of the proposed approach is described in commercially-available sensor network hardware.

The research community in WMSNs is very vast and active, but as yet, many of the proposed solutions are evaluated through simulations because of the extensive evaluation of a multi-hop streaming video system based on the stranded development framework of TinyOS and the lack of accessible video system implementation. It is recommended then to use a freely available source code to perform evaluation of other network analytic measures for the design of secure multimedia communication applications. The implementation of a secure video streaming system at different layers of communication stack is described in details in the following sections.

III. MICA HARDWARE PLATFORM

Mica2 mote represent the main hardware component of the underlying wireless platform and it is built around an integrated micro controller that consists of the ATMega 128L processor, 512 Kbytes of on-board storage and a low-power AVR eight-bit processor with 128 Kbytes of flash program memory [10].

Figure 1 illustrates a schematic of the sensor unit component, showing the sensor board layout, the mote layout and the power supply. Moreover, multimedia capability is added with the help of a multimedia sensor board (IMB400), which includes camera sensor among others.

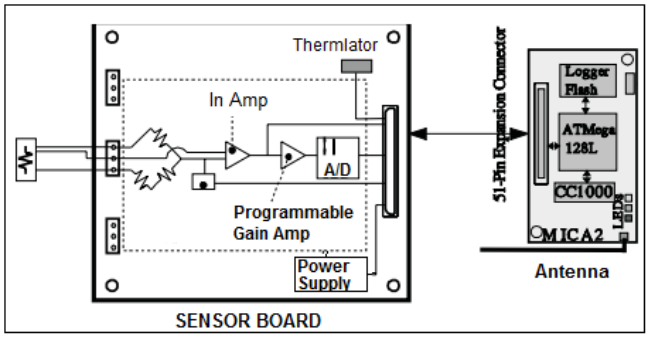

Figure 1 Schematic of the Sensor Unit.

The detailed implementation of the video streaming system and its related layers of communication is described in the following subsections.

A. Adaptatioin Mechanisms of the Application Layer:

The video system utilization of the application layer multicasting principle can be further adapted to transmission of multimedia video stream. is described starting from the application layer and the multimedia technique adapted. High compassion efficiency, low complexity and error resilience represent the main design objectives of a multimedia coder for WMSNs.

A video sequence is compressed once with a complex encoder and decoded several times with simpler decoders in the traditional broadcasting paradigm. Encoders such as the ones in MPEG or H. 264 depend on demanding processing algorithms and might not be supported by sensor networks due to their low-processing power and limited energy budgets nodes. This explains why the previously mentioned paradigm might be unfeasible for WMSNs and encoding techniques like distributed video coding [11] might be promising.

An effective hybrid DPCM coding system is adopted then to achieve an acceptable compression output and to keep the computational complexity low. The first frame acquired from the IP camera is processed by the sensor node to produce a JPEG coded frame. The standard JPEG baseline is used here with quantization of DCT coefficients that are followed by RLE and Huffman coding. For subsequent frames, the only difference with the previous frame is that it was encoded and, thus, produces a compressed bit stream. On the decoder side, the received frames are stored in a buffer and are summed to subsequent prediction residuals in order to reconstruct the original sequence. In addition, a block diagram of the implemented Motion JPEG with Differential Encoding (MJPEG-DE) is presented in Figure 2. It starts by encoding the input frame using DCT transformation technique and the resulting coefficients are

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identified by the difference between each successive frame and quantized due to a specified quality factor. The resulting bit stream is encoded using run-length coding (RLE) mechanism. In the video compression encoder, the resulting JPEG code frame is reconstructed and stored in a buffer for subsequent DPCM encoding and before transmission. In the receiver side, the input bit stream is decoded and added to previously reconstructed frames

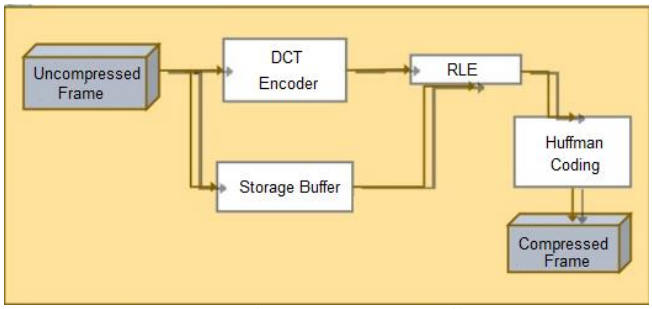

Figure 2 Diagram of Motion JPEG with Differential Encoding

In the proposed implementation the video encoder produces sequences of frames to achieve an average compression ratio of 27% without any degradation of the quality of object detected nearby the gas pipeline platform. Regarding frame acquisition and processing time, typical results for all images used in the test sequence have people detection at 2.8 fps at QVGA (320 x 240 pixels) image resolution with acquisition process of 2-3 frames or 60-90 ms. Therefore, the proposed real-time video surveillance system is composed of two cameras and multiple low-cost wireless sensors in architecture where the sensor network would detect and trace an object and wake up the surrounded by cameras to record those events as shown in Figure 3

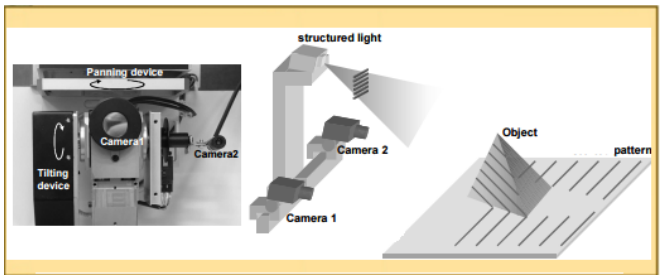

Figure 3 Active sensor system for environment perception

B. *Adaptatioin Mechanisms of the Transport Network and MAC Layer:*

Timeliness and reliability are the two main objectives in the design of suitable network protocols for date delivery in WMSNs. Timeliness is of greater importance when it comes to multimedia applications as real-time is often required due to the connectionless transport protocols that are based on UDP . Date packets are originally generated by compression techniques such as the one illustrated in section III-B. Those packets have different priority and cannot be dropped. I-frames, for example, carry content that cannot be concealed if they are lost and their transport should be secured as well. Then reliability of major impotence along with a congestion control mechanism that adapts the packet generation rate of the source to the current level of congestion in the network. TCP–based protocols should by no means lack reliability and congestion control, otherwise no single transport protocol would address the diverse concerns of WMSNs.

C. *Congestion Control Adaptatioin Mechanisms :*

The wireless medium is originally unreliable and the capacity of each link relies mostly on locations and varies continuously and might be burst as well.

The big receptive rate of packets, if compared to forwarding packets and the limited memory size of sensor nodes cause packets dropping because of buffer overflows. An explicit and recursive congestion control mechanism is implemented have to cope with this situation. Each node has two thresholds called stop threshold and restart threshold respectively. They allow to know if the buffer is near saturation and to take the proper countermeasures. If the incoming messages buffer size is bigger than the stop threshold, the node will continue to accept new packets but send an explicit control message to its source node. When receiving this message, the source node will stop to send packets and will remain in this state until it doesn't receive any other control messages from its destination node; it can restart sending packets.

Regarding the MAC layer, the proposed solution depends on the standard IEEE 802.15.4 CSMA protocol with clear channel assessment (CCA). At the network layer, a static routing protocol is used with each node knowing address of its next hop to forward multimedia data. It is planned here to integrate the proposed video system with a more elaborately routing protocol through which the nodes can associate with the network and receive network addresses and vice versa.

D. *Software Support System:*

To develop video functionality onto the sensor notes, it is required to implement Java environment to facilitate the interaction between the user and the sensor network and to display both video streams and images. Java support is based on a simple producer/ consumer synchronized multi-thread algorithm with two process which fill in/empty the buffer. The receiver thread is directly connected to the sink node through serial communication and it responsible for arranging the received packets and reconstructing a frame. If the frame is not received because of the loss of one or more packets, subsequent frames must be discarded until the synchronization is restored.

Moreover, if the receiver thread finds that the sequence of the inner parts of a frame or the frames flow are broken, it stops saving the incoming data and sends a control message to the camera mote.

When receiving this message, the camera mote blocks the DPCM encoder and proceeds in transmitting a new I–frame. On the other hand, the display thread reads the reconstructed frames from the butter, decodes I and P frames properly and displays the streamed video using Java libraries. It gets started just when the buffer contains a large number of frames.

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In congestion control mechanism, the frame rate depends on the actual congestion in the network and the display thread adjusts its reading rate that is based on the estimated number of frames written in the buffer by the receiver thread.

This procedure would guarantee the reproduction of a fluent video without consuming the buffer content too fast with respect to the buffer refilling rate. Then, when the buffer is empty, the display threads stops and waits for the number of frames in the buffer to become sufficient. Graphical user interface allows requesting a video or an image explicitly from the camera motes. Supported resolutions for images are 640 x 480 (VGA) & 320 x 240 (QVGA) within or without JPEG compression. As for supported resolutions for videos are 320 x 240, 160 x 120 and 80 x 60.

IV. BENCHMARKING AND VALIDATION

The developed video streaming system, as previously explained, depends on the standers IEEE 802.15.4 and MAC layers. Up to this step, it is about time to evaluate the actual capacity offered by the reference hardware/firmware platform. Ten kilobyte of date segmented in packets of different size are sent (the 802.15.4 maximum packet size is 128 bytes) and four configurations in which the clear channel assessment and the acknowledgments of packets are switched on/off to be tested. If both CCA and ACK are not used, the maximum achievable date rate is about 160 kbps; where 60% of the nominal 250 kbps data rate of 802.15.4. In the proposed video system, where CCA and ACK systems are used with the packet size of 56 bytes, the experimental date rate is about 50-60 kbps. Data rate could be increased by increasing the packet size, but TinyOS demonstrated problems in receiving packets greater than 60 bytes at high rates. The experimental data rate achieved on a point-to-point communication between two nodes with different configuration of the MAC protocol is illustrated in the following sections:

As previously mentioned, the proposed congestion control mechanism depends on two thresholds: the "stop threshold" and the "restart threshold". The former represents the maximum buffer occupancy which triggers a stop message sent back to the previous node along the transmission path. The latter determines the time after which the transmitter is reactivated. The proper setting of the threshold values is quite essential for the operation of the whole video delivery mechanism. However, the stop threshold should be set high enough to guarantee continuous transmission of packets while bounding the buffer overflow probability. Quantitative tools to set the stop threshold will be provided and a close form expression for the packet dropping probability will be derived due to the buffer overflow. If A_T is considered to be the average time taken by the stop message sent by a congestion node to travel back to the traffic source, A_T will obviously depend on the quality of the backward link towards the source. In other words, if this link is characterized by an average packet error rate E , one can write:

$$A_T = \sum_{i=1}^{\infty} i(1-E)E^{i-1}\left(\delta_{Tr} + \delta_{cca}(i)\right) \quad (1)$$

With δ_{Tr} as being the time to complete a successful transmission on the backward link which includes the transmission time for the acknowledgment and the propagation delays. On the other head, $\delta_{cca}(t)$ is the time 'lost' in the CCA/CSMA procedure at transmission retry *t*. Then the packet dropping probability can be estimated as the probability of receiving more than $'\beta'$, where β = buffer capacity – stop threshold packets during A_T, that is

$$E_{\propto} = \sum_{i=\beta}^{\infty} \frac{\alpha A_T{}^i}{i} - \alpha A_T \quad (2)$$

This equation describes the lost packet probability as a function of the packet error rate, the source rate α and the parameter β. For this parameter, a qualitative estimate can be obtained assuming the independency on the transmissions from the source and the transmissions of the stop message. Therefore, the time for clear channel assessment at the generic transmissions attempt i of the IEEE 802.15.4 standard will be equal to quadruple of the back off periods. It is clear that the packet dropping probability is a function of the parameter β for different values of the packet error probability It is quite clear then that a value of parameter β around 4 leads to a target packet dropping portability of 10^{-4}.

V. SECURITY FLOW CONTROL DESIGN

A Multimedia wireless sensor network is usually composed of hundreds or thousands of sensor nodes which can sense, process and transmit their monitored data to mobile or base stations in autonomous manner. Despite of ease of deployment, potential applications and significant advantages, WMSNs are highly prone to security threats due to their limited resources and the nature of environments in which nodes operate.

While most of these attacks can be dealt with through cryptographic security protocols provided by key management schemes, there are always a few that manage to really cause problems. One such attack that is most common and significant in WMSNs is cloning attack. In clone attack, the intruder tries to capture and compromise some nodes and inject them into several locations throughout the network in order to conduct other types of attacks.

In this section, some of the challenges facing the multimedia wireless sensor networks such as security, routing, computing capability, and battery power will be discussed. The main goal is to utilize more secure communication and to show the possibility of using clustering techniques while maintaining overhead in minimal levels. The design details of the protocol, including aims, and architecture are concerned with confidentiality, Integrity and authenticity of communication in a sensor network.

Compared to conventional computers, the threats to wireless sensor network platforms increased exponentially, including node capture, denial of service, energy drain, and tampering physically. Securing such nodes, then, is quite important and more attention should be paid to it, as heavy date exchange and computing power prevail in every single domain [12]. Rapidly, different security measures have been developed to secure wireless communication systems and

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security countermeasures have been adapted to different layers of software supported on these WMSNs to secure the data they access and the shared information between sensor nodes [13].

To secure data in WMSN, it has been suggested that the data should be encrypted using light weight encryption techniques such as stream cipher. The majority of encryption models that aim at preventing intruders from hacking wireless sensor networks use stream coding based on linear feedback shift registers (LFSR). LFSR is a device that generates long binary streams and is very familiar to most cryptographers and coding scientists. In contrast; LFSR is used in wireless communication to generate a session key. Implementing the next key function of an LFSR in hardware requires only a few XOR gates. However, LFSR needs hardware implementation and cannot be used directly to generate suitable session keys. In our mode, a random number generator combined with RC4 stream cipher is used to generate the session keys [14]. Sensor nodes then employs the session keys for encrypting whatever data is going over the wireless communication channel. The proposed method is simple to implement and provides a robust approach to secure confidential data in WMSNs [15]. In addition, this method does not require any hardware implementation as compared to LFSR which requires the system to be implemented in hardware, and hence minimizing both the hardware overhead and the impact on system's performance.

In our model we are concerned with LEACH (Low Energy Adaptive Clustering Hierarchy) protocol. Our main goal is to minimize energy consumed in WMSNs and offer a better assignment for cluster heads without adding any overhead. WMSNs have limited energy and computational power. In this paper, we aim at preserving nodes energy as a result of decreasing computation cycles used in calculating the threshold value needed by LEACH [16]. Such instruction is repeated at the beginning of each round which consumes a lot of energy, and by using LFSR will reduce the computation needed and will assign cluster heads based on more knowledge of the network. The base station BS in the network is responsible for creating LFSR session keys.

To find the node centrality, the base station selects each node and calculates the sum of the squared distances of other nodes from the selected node. We are going to use same factors in electing a cluster head using Mobile Agent MA protocol [17] , [18] as illustrated in the following equation:

$$EU(\sigma|E) = \max \sum_i U(A) * P(A)|D_0(A), E) \qquad (3)$$

Where σ is the current best action, *E*: agent current knowledge, *A*: action to choose from, *P(A)*: probability of occurring of results needed after applying action *A*, *U(A)*: weight or preference based on the current state.

In addition, we are going to rely on the MA itself to gather more information about the node centrality rather than relying on the BS, which will save a lot of time and will save bandwidth for the overall multimedia network.

LEACH has a major disadvantage in the CH probabilistic election, two CHs might be selected in close vicinity of each other or CHs nodes can be located near the network edge which will make it unreachable and will consume resources unnecessarily. Also each node has to calculate the threshold and generate the random numbers in each round, consuming computational power and hence energy of WMSNs.

Using clusters introduces a scalability feature to the network when compared to the flat model. Introducing clusters reduces communication overhead and put the whole multimedia network in a structure which can be optimized according to resources available. Our model depends on LEACH routing protocol, the election phase is going to be altered to utilize MA. The main important advantage of using MA is their ability to take a routing decision and the timing of the migration is an essential aspect as well. We are going to make use of this feature and assign one MA for each cluster. The first MA initiation is carried out by the BS. We assume a fixed; no mobility feature in all multimedia sensor nodes. The election in LEACH is carried by computing the threshold using the following equation:

$$C(n) = \begin{cases} \frac{H}{1-H*\left(r \bmod \frac{1}{H}\right)} & if\ n \in g \\ 0 & otherwise \end{cases} \qquad (4)$$

Where *H*: is the percentage of CHs, r: current round number, g: group of nodes where the node was not elected a CH in the past 1/H rounds [6].

Initially, when clusters are being created, each node decides whether or not to become a CH for the current round. This decision is made by the node choosing a random number between 0 and 1. If the number is less than a calculated threshold in the cluster *C*(n) value from (1), the node becomes a cluster head for the current round.

As known about LEACH, the number of CHs in the network is fixed; our model on the other side will offer a dynamic formation of the network to give a more flexible structure at the beginning of each round. Our model is concerned also with multimedia network statistics, topology, concentration of nodes and number of peers in cluster. The MA has utility functions declaring their preferences and the MAs main obligation is to maximize the expected result of utility function based on our current knowledge of the WMSN network.

According to equation (3), the action to take is the choice to be elected as a CH based on the location (*x,y*) coordinates, the location of the node related to the peers in cluster and the current energy resources. Our model also suggests the ability to carry out LFSR key management operation, and MA can secure key distribution after the CH has been elected. After the election, the CH will create symmetric keys for the nodes in the cluster. Following that, the MA will traverse the peers in the cluster and each node is assigned its corresponding key.

As illustrated in equation 3, the MA of the CH bases each action on the knowledge of the network: Routing information, cluster nodes locations, energy and the concentration of nodes around the CH.

After computing the utility function at each MA, we are going to perform validity analysis. This is a very important step to check whether the decision made is sensitive to small

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changes in the assigned parameters. If the analysis lead to a dramatic change in the decision made, this is an indication that we need to allocate more resources to gather more data. For example, spend more time to learn more information related to the WMSN topology.
If all variations over the parameters gave the same decision, this gives more confidence to the MA that the decision made is the best decision. This analysis makes our agents more able to make better decisions and improves reliability.

VI. Security Analysis and Countermeasures

This section discusses the results of the proposed method. It also presents the obtained driving strategies and the test cases that show how the proposed WMSN is secured. In order to implement such strategies, one must go through several steps which were discussed in details in the preceding sections. It is among all base stations and sensor nodes of the same traffic type. A key is used to secure communications between nodes as well as decipher broadcast frames from the base station. The following notation is used throughout the remainder of this section: BS and SNs refer to Base Station and sensor nodes. K: is a private key, whereas *EC* is an elliptic curve and *G* the generator number. M: is a message (stream of bits), *C* is the cipher, *R( )*: is a family of pseudo-random numbers, *AC* (*C, K*): is an authentication code of the encrypted data which uses the same Key.

It is assumed that the Base Station itself is highly secured. Messages between base station and SNs are encrypted by ECC algorithm. The advantage of using ECC is that it provides an equal security as RSA but with less overhead in the processing of messages. Thus, to secretly communicate with each other and SNs must have keys which are known only by the BS.

A random public point *G* is chosen on the elliptic curve EC to produce a compressed public key [26]. In addition, BS chooses a random number RBS.

Then, the BS computes it session key SRBS = RBS * G using the LFSR protocol and the nodes also compute shared session key that each one share with the CH. Hence, this session key is used to secure communication between the CH and its sensor nodes within the cluster. The cipher C is used to denote the encrypted message M with the shared session key K. After this message is encrypted, the authentication process takes place. In order to verify data authenticity and integrity of the message M, it uses a key to authenticate messages, for example ECC. The encrypted messages then sent by CHs to the BS within a secure channel. It is assumed that the BS has a powerful computing power and more energy than regular sensor nodes.

Thus, after establishing the first channel of communication between the BS and SNs, the BS authenticates the shared session key until the end of the session. In this manner, the BS also distributes and authenticates session keys to the CHs. In the following section, the performance evaluation of the proposed model is presented.

VII. Performance Evaluation

For the sake of evaluating the performance of the proposed system, several experiments were carried out where a camera mote acquires a video and sends it to the BS through all the CH nodes. As previously mentioned, a security LEACH protocol was adopted and each node transfers its data through the CHs. Then, each test will be carried out to simulate the results and the resulting values will be averaged over the observation results.

In the first experiment, the performance of the proposed security protocol was tested, as each forwarding node requested acknowledgements only for I-frame, whereas P-frame were allowed to be lost. The different performance between the proposed method and a totally secured protocol (where the camera node is connected directly through a serial interface to the BS) is shown in Fig. 4.

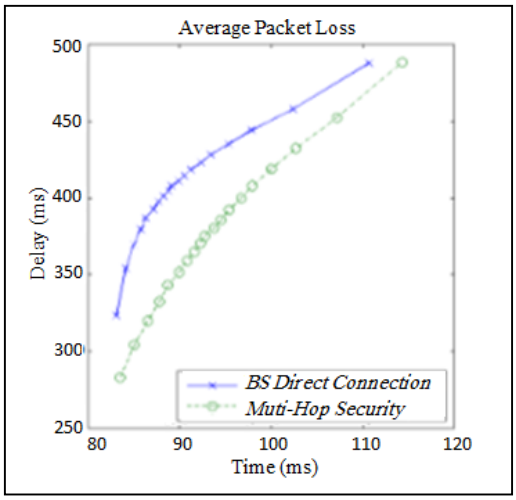

Figure 4. Average End-to-End Dely

When ACKs for all frames are requested, the averages reception delay varies from 400 ms at one hop to 600 ms at three hops, but no frames are lost.

On the other hand, when our proposed security protocol is used, the average reception delay is higher due to the overheads; ranging from 740 ms at one hop to 920 ms at three hops, but as yet the frame loss percentages is lower and more secured. In the unsecured configuration, for example, 75% of the frames were lost, resulting in an unacceptable video streaming quality. ACKs were thus requested for any frame in the subsequent experiments. Moreover, the total system end-to-end delay was evaluated including both the reception delay and the delay introduced by the buffer at the BS.

In the second experiment, the performance of the hybrid encryption secure routing protocol was evaluated in terms of peak signal to noise ratio (PSNR) and average frame rate. The system frame rates are reported at different resolutions and for different network depths as shown in Fig. 5. Consequently the frame rate is limited to very low values due to the low processing capability of the sensor nodes and computing overhead of security protocols.

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Also, the average rate-distortion curves for different video resolutions were shown, varying the quality factor of the JPEG compression stage. In the implementation, the quality factor corresponds to a scaling on the DCT equalization matrix as higher values mean larger quantization coefficients, resulting in a reduced frame size and visual quality.

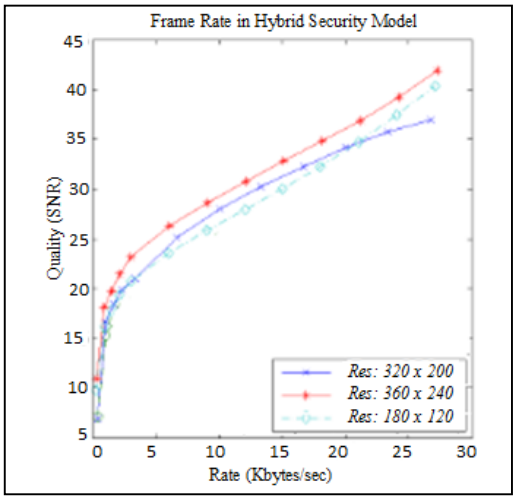

Figure 5. Quality Analysis of the Proposed Model

The added camera chip driver allows acquiring only high resolution images and in order to obtain resolutions that are adapted with the security protocols, an average down sampling was used, where each pixel in the down sampled image is obtained by averaging an area of pixels in the original image. Such choice will not add excessive computational complexity on the mote's processor but causes worse PSNRs at lower resolutions.

VIII. Conclusion and Future Work

The main objective of this work was to implement and evaluate a scalable secure multimedia communication on wireless sensor networks. We have implemented the proposed mechanisms on a mote platform, and our results confirmed that our proposed approach can successfully provide secure multimedia communications and yields, at present, a slightly degraded video transmission quality. This system features the acquisition of video data in different resolutions, speed, and quality. Ultimately, experiments were carried out to evaluate the performance of the proposed solution in terms of PSNR, frame rate, and average delay. The whole system relies on hybrid encryption secure routing protocols that can defend against all standard threats and known attacks while minimizing energy consumption in wireless multimedia sensor networks. Future work will focus on the integration of video system with more efficient secure routing protocols, the compression of the proposed solutions with other multimedia encoding and decoding techniques, and analysis of energy consumption by including more nodes through the use of multiple paths to route traffic efficiently and securely with less power.

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An Analysis of Six Standard Ontology Editing Tools for Capturing Entire Crop Processing

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Abstract--**In the past decade, the ontology development community has witnessed several platforms and tools for ontology building. All these tools facilitate ontology development processes and direction for the subsequent usage. However, research has shown that current ontology editors do not effectively capture agricultural processes. Existing ontology editors do offer explicit but incomplete agricultural process information. This research proposes the need for a new ontology editor for process capturing, specifically capable of capturing entire cassava plantation process, which can be used to develop Intelligent Tutoring System (ITS) for farmers on crop processing. To this end, this paper examines, analyzes and presents the results of selected ontology editors. The comparison was done using different criteria including an ontology editor's strength, weakness and suitability for capturing entire crop plantation process.**

Keywords: Ontology editors, Ontology, Protégé, Apollo, KAON2, SWOOP, WebOnto & Ontolingua

1. INTRODUCTION

The knowledge base that formalizes all aspects of a particular crop, in this case, cassava, will contribute to the preservation and dissemination of cassava information to aid agriculture professionals in plantation and development of crop process ontology. The crop process ontology is anticipated to be broad enough for adaptation and reusability for other crops in the agriculture domain.

Information on crop plantation process has become critical especially when it comes to issues of soil preparation, crop diseases management, quality and quantity of output to name a few. Thus, the capturing and documenting crop processes have taken center stage in agriculture domain. Knowledge of a concrete and or entire crop process is necessary for the development of Intelligent Tutoring System (ITS) to aid farmers and other agriculture-related professionals. Development of a comprehensive ITS for a particular crop requires information on entire plantation process for that crop. This need for a comprehensive ITS necessitates the requirement for a new ontology editor capable of such information gathering.

This study intends to offer a concept of an ontology editor, capable of capturing entire agricultural production process for a particular crop. The captured data, would enable the design of Intelligent Tutoring Systems (ITS) that cover all operational stages, from soil preparation, planting, pre, post harvesting and other vital information requisites for a crop, such as cassava production life cycle.

II. CASSAVA FARMING in NIGERIA

Knowledge of Cassava farming is of interest, particularly to Nigerians and also, to the rest of the cassava consuming and producing world. Cassava farming knowledge is usually passed on from generation to generation in the families or from trainers to learners in specialized agricultural institutions and or organizational settings. Information on Cassava processing, for example, is currently dispersed, disorganized, and are in varying stages of the plantation [1]. Thus, the continued

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absence of ontology editors that would accurately capture and preserve the knowledge of entire crop processing would be devastating in the long run. This researcher believes that farming experiences would be lost as farmers gradually shift to other trades due to urban migration and lack of interest of the young generation if nothing is done to preserve such knowledge.

III ONTOLOGIES

Significant research and progress have been made concerning ontology development ideas and editors. Generically, an ontology goal is to gather and organize specific domain knowledge and provide this information in an acceptable standard. The information, include common conceptualizations of a particular domain and the representations of these concepts [2]. This concept of ontology has indeed encouraged and produced numerous ontology editors. Ontology is perceived as a pillar for different types of knowledge management for information storage, retrieval, and sharing.

Ontology design requires the application of software tools, available in commercial or open source, known KAON2, SWOOP, WebOnto and Ontolingua with a focus on the breath, depth of the weakness and suitability of these tools for capturing entire crop process, such as cassava plantation.

4.1 Protégé

Stanford Medical Informatics developed Protégé. Protégé is a Java-based tool equipped with an extensible plug-in architecture, which enables rapid application development and prototyping. Protégé allows a user to construct domain ontologies, create data entry forms, and collect data for added plug-in functionalities. Also, Protégé enables the definition of classes, relationships, and properties, the hierarchy of classes, variables and value restrictions [5]. It is equipped with OWL API that encompasses the core API, which enables access to OWL ontologies. Diagrams and tables are constructed using graphical widgets; however, the addition of new basic types is difficult. On the contrary, Protégé is designed with visualization packages such which help the user visualize ontologies using diagrams. Importantly, for the ontology community, Protégé is a free open-source tool that can be used to construct various knowledge bases [6].

as Ontology Editors [3]. Such editorial tools can be used at different stages of design, deployment and maintenance of an ontology development life cycle. This paper analyzes some of the popular ontology editors for entire process capturing capability, role, and necessity for constructing ontology editor to support more expressive control and process capture.

IV. ONTOLOGY EDITORS

Ontology editors are used in designing ontology to facilitate excellent information sharing among system users and or software agents. Currently, a variety of development platform exists for construction of ontologies. These platforms are designed for the building of a new ontology either from beginning or reuse of existing ones, to support import and export of diverse formats, viewing and editing capability, browsing libraries and documentation with integrated inference engines. Also, users are provided the opportunity for inspection, visual manipulation, coding, maintenance and other support [4].

In this analysis, we reviewed six popular, standardized and widely accepted ontology authoring tools for constructing ontology schemas, using or without instance data; namely Protégé, Apollo,

4.2 Apollo

Developed by the Open University of United Kingdom Knowledge Media Institute, Apollo tool provides the user the opportunity to model ontology with basic primitives. The Apollo model is based on Open Knowledge Base Connectivity (OKBC) protocol. Apollo knowledge base consists of hierarchically organized ontologies, which can be inherited from other ontologies. Inherited ontology usually contains all primitive classes, such as Boolean, float, integer, list, and string to name a few. The class contains template and non-template slots, which can be used to generate instances. Apollo is written in the Java language, not bound to any language and can be extended to different formats of I/O plug-ins. Also, it allows implementation of other knowledge bases, but it does not support collaborative work [7].

4.3 KAON2

KAON2 is a framework for managing OWL-DL, F-Logic, and Semantic Web Rule Language (SWRL) ontologies. Developed by the University of Karlsruhe AIFB Institute in collaboration with University of

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Manchester, Information Management Group (IMG), and Information Process Engineering (IPE) at the FZI Research Center in Germany. KAON2 differs from KAON1 which focuses on business applications; it supports scalability, RDFS extension with symmetric, inverse and transitive relations in addition to efficient reasoning with ontologies and meta-modeling using axiom patterns. KAON2 supports ontology languages such as OWL-DL and F-Logic. KAON2 tool is designed with two user-level applications: KAON PORTAL and OiModeler. All other applications and modules are designed for software development. KAON PORTAL enables ontology navigation and search using a Web browser; while OiModeler is the main editor for ontology creation and maintenance [8].

4.4 SWOOP

Developed by MND University of Maryland, Semantic Web Ontology Overview and Perusal (SWOOP) are an open-source, hypermedia inspired Web-based OWL ontology editor, written in Java. Designed with OWL validation, presentation syntax views and enables multiple ontology environments. SWOOP main features include comparing; creating, editing, and merging of ontologies, with the key features of collaborative annotation, SWOOP is a powerful Web ontology editor. However, it cannot capture process, especially entire crop planting and harvesting process, such as cassava. SWOOP is known not to follow a particular method for ontology design; neither does it allow fractional imports of OWL [9].

4.5 WebOnto

Developed by the Open University of England, Knowledge Media Institute to support the design, editing of ontologies, and collaborative browsing. WebOnto was constructed using a Java-based central server and encapsulated in OCML knowledge modeling language. The main characteristics of WebOnto are the automatic instance-editing, forms generation from class definitions, inspection of elements, consistency checking, management of ontologies using graphical user interface; support for collaborative work; receiving and making annotations [10/11].

4.6 Ontolingua

Developed by Stanford University Knowledge Systems Lab, OntoLingua as its popularly known is a tool that supports collaborative editing, browsing, creation and distribution of various ontologies. Also known as Ontolingua Server frame-editor has other systems such as Open Knowledge Base Connectivity (OKBC) Server, Webster, and Ontology merge tool embedded into it. Ontolingua, a form-based Web interface was designed to facilitate the development of ontologies. It features support and enable consensus on common shared ontologies. This editor supports collaborative editing, browsing, distribution and creation of ontologies. Also, it provides users opportunity to access and assemble information from a library of modules and reusable ontologies. The user access level assignment and write-only locking functions provide multiple users' concurrent access to Ontolingua. Ontoingua's ontology collection supports and can be accessed through a browser, and it enables translation of different formats [12].

Table 1: Comparative Analysis of Ontology Editors Reviewed

Features	*PROTÉGÉ*	*APOLLO*	*KAON2*	*SWOOP*	*WebOnto*	*Ontolingua*
Availability of Tool	*Open / Free*	*Open Source*	*Open Source*	*Open Source*	*Open Source*	*Free @ evaluation period*
Software architecture: Extensibility, stand-alone, client/server or web-based	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*
Interoperability: enable import & export from languages, merging, annotation, storage,	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*
Inference engine & Exception Handling	*YES*	*NO*	*NO*	*NO*	*YES*	*YES*
Editor usability [ease of use]	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*
Process capturing & modeling: such as cassava plantation & other crops	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*

The table above presents a comparative analysis of selected Ontology editors based on the following criteria:

Availability: access to these ontology editors varies, based on developers, most are open source and free, while others are commercial packages. Editors used

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for these studies are open source and free, which perhaps explain why they are very popular and common.

Software architecture: A significant aspect of ontology editor analysis is the architecture, which covers platform information, stand-alone, client/server or web-based; extensibility, and storage of ontology data.

Interoperability: a review of capability to interact with other development tools and languages. The four editors reviewed supports merging features, import and export to and from various ontology languages in a range of formats such as XML IDL, KIF, RDF (S), XML(S), OIL, DAML, RDF OCM, OWL, CLOS, Clips, and UML.

In summary, the comparison table presents different properties and functionality used in this analysis. A YES is scored where one or more functions are applicable and an N/A where not applicable. The analysis resulted in the fact that none of these editors are suitable for capturing entire crop process, particularly, knowledge of Cassava Plantation cannot be modeled, which necessitated the need for a flexible editor that can target knowledge engineering.

V. ESSENTIAL FEATURES of REVIEWED ONTOLOGY EDITORS

5.1 Protégé 2000

Essential features include: Import format for XML, XML Schema and RDF(S), Export format for XML, XML Schema, RDF(S), CLIPS, FLogic and Java HTML. Graph view format using Jambalaya plug-in for nested graph view, GraphViz plug-in for browsing classes and global properties.

Consistency checks thru plug-ins using PAL and FaCT, Protégé designed is designed with limited multi-user capabilities, which enables multiple users' interacting with the same database, executing incremental changes without conflict. However, simultaneous changes to the similar data will cause unwarranted problems since there is no support for multiple system users modifying same elements. Protégé provides Web support through OWL plug-in without direct support for Web knowledge base, with the use of servlets; these knowledge bases can be accessed.

Inference Engine: the selected tools are designed with constraint, consistency checking mechanisms, and exception handling. Protégé is the only tool from those analyzed that has a built-in inference engine, KAON2 uses exception handling and others are designed with external inference engines.

Editor usability: addresses ability of this tool to collaborate with other ontology editor's library, versioning and visualization. This study suggests the need for more features and to improve available ones such as edition, help support, and visualization to ensure successful collaboration in ontology construction.

Process capturing & modeling is the ability of ontology tool to capture entire crop processes, specifically for crops like cassava.

In addition to Extensible plug-in architecture, storage capacity, Database and File, one added the advantage of Protégé is that t allows users to browse the knowledge bases without installing the Protégé application.

5.2 Apollo

Essential features include: Import/export format for OCML and Common LISP Object System (CLOS) and does not support graphical view. Inconsistency, Apollo's object model feature allows for robust typing, which enable value check during editing for precise type and existence. Apollo features do not allow undefined instances and classes, neither can you create instances of such classes nor edit their slots, and unclear instances are immediately discarded from the ontology when no reference is made to these instances by any slot. Apollo promises support for weak typing, Metaclasses, support for multi-user, extensible plug-ins, ontology storage and library, all in the future.

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5.3 KAON

Essential features include Import/export format for Resource Description Framework Schema RDF(S) and does not support the graphical view, have internal consistency check and Web support thru KAON Portal. KAON provide a multi-user support, it enables transaction oriented locking, rollback and concurrent access control. Additionally, KAON features allow scalable and efficient reasoning, Meta-modeling comparable to F-Logic via axiom patterns, extends RDFS with symmetric, transitive and inverse relations

5.4 SWOOP

Essential characteristics include Import and Export format for Resource Description Framework Schema RDF(S), OIL, DAML+OIL, SHIQ, dotty and HTML. SWOOP does not support the graphical view. Consistency checks capability thru built-in FaCT. SWOOP has limited web support for RDF URIs, namespaces, and inadequate XML Schemas. In-addition, SWOOP features arbitrary class expressions, which could be used as slot fillers; Concrete type expressions that are not adequately supported; Primitive & defined classes; XML Schema types; Storage and File without extensibility.

5.5 WebOnto

Essential features include Import and Export format for RDF, GXL, RDF(S) and OIL, Web support, Graphical view with little consistency check and multi-user capabilities. Also, WebOnto is designed with Multiple inheritance and exact coverings; a Global write-only locking with change notification; Online service, Ontology Storage and File; Built-in inference engine, Collaborative environment, Meta-classes; Class level support for Prolog-like inference and Information extraction using MnM. WebOnto does not support merging and extensibility.

5.6 OntoLingua

Essential feature includes Import and Export format for IDL, KIF, CLIPS, OKBC and PROLOG syntax. Supports limited consistency check using Chimaera. Provides free web access, storage and files. OntoLingua also provides Multi-user support by write-only locking and user access levels. However, OntoLingua does not support graphical view and no extensibility.

In this section, we have described the essential features of the above ontology tools; Protégé, Apollo, KAON, SWOOP, WebOnto and OntoLingua. Each of these tools is for ontology development. To complete the study, and for the purpose of this research, we choose tools of similar use, for comparison of these tool's features in regard to process capturing.

It should be noted that many other Ontology tools serve a different purpose. For example, PROMPT FCA-merge and Chimaera, are ontology merge and integration tools; COHSE, AeroDAML, OntoAnnotate and MnM are ontology annotation tools. Redland, Sesame, rdfDB, Inkling, cerebra and Jena are ontology storing and querying tools.

We analyze several important aspects of these tools such as the capability of import and export format; the graphical view, multi-user support, extensibility, merging, consistency check, web support, ontology library support and storage, etc. The majority of the Ontology tools reviewed are moving towards Java platforms and extensible architecture, ability to capture entire plantation process, Interoperability and data storage remains the weak point of all these tools.

In conclusion, we have studied some of the advantages and disadvantages of these tools as it relates to entire Cassava process gathering. We conclude that none of these tools have the necessary features to capture entire cassava plantation process.

VI. CONCLUSION & FURTHER RESEARCH

This paper reviewed and analyzed the deficiencies of some of the popular ontology editors and proposed a need for a new ontology editor, capable of capturing entire crop processes. In the final analysis, we can

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extract the following conclusions. There is no ontology editor designed for agricultural process capturing. Since there is no crop process ontology editor, attempts to modify existing editors is rather complicated in the ontology construction task. In fact, there are many ontology building tools available; most of these editors focus on particular and a few different activities of the ontology lifecycle design; such as editing, documenting, importing /exporting for the various formats, graphical views, ontology libraries, inference engines and browsing functionalities. In conclusion, none of these editors with similar functions can serve the purpose of process capturing. Thus, there is a necessity for a new ontology tool that would capture entire crop process, similar in complexity to cassava plantation.

For continue research, process capturing, merging tools, databases, interoperability with other ontologies/editors, language translations, storage and backup management are an essential improvement in Ontology editor development to avoid additional challenges and improve user experiences.

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Implementation and Security Development Online Exam, Performances and problems for Online University Exam

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Abstract

In this paper, I developed and implemented a web-based Online Exam System application at Sur University College with some additional security features using biometric devices, network protocol and object oriented paradigms to improve online examination systems.

I proposed a framework for secured online exams. The proposed application used as a case study at Sur University College for the placement / entrance exams and any other course that offered by the college. Primarily aim to incorporate examination structure comprising of Multimedia questions, Labeling diagrams/maps, Sentence completion, Gap-fill, Multiple-choice questions, True/false/not given statements, Matching headings, Ordering paragraphs, Graph description, Audio/video files. The candidates will enter the answers accordingly and be evaluated automatically by the system. The institution will be able to access the scores and further evaluate the performance of the candidates in accordance with the admission criteria.

Keywords
Online Exam, Offline Exam, Biometrics, IP Address, Packages, University Course, Student Grade, Biometric

INTRODUCTION

Online Exam has prolonged fast, even so, the off-line exam is usually chosen as evaluation method for both on-line and off-line exams systems that send the data packages from client when user finished all of the answers to submit it into the server. The Online Exam systems are replaced nowadays instead of traditional exams that Instructor makes it [1], [2].

Online Exam is a tool depends on new technology that improves and enhances the examination rather than the traditional examinations systems that used the papers and pen to conduct the Course Exam in any educational institution.

I implemented and developed an Online Examination System for educational institutes (University, College or School). Primarily, I aim to incorporate examination structure comprising of MCQs, Fill-in-the-blanks, True and False Statements, and Audio/Video files True and False Statements, Gap-fill Tasks, Audio Files and Images, Graph

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Description). These questions will be displayed in a form of an exam to the eligible students. The answers entered by the students will then be evaluated and their scores will be calculated and saved. The institution to determine the passing students and/or to evaluate their performance can access the scores. The candidates will enter the answers accordingly and be evaluated automatically by the system. The institutions will be able to access the scores and further evaluate the performance of the candidates in accordance with the admission criteria.

Related work

1. Mutah University [3], one of the governmental universities in the Kingdom of Jordan, uses Online Exam System. Their system provides placement tests as well as formative and summative tests for all university courses. They use a common type of Online Exam System with alternative questions. Our goal is to enhance the online exam system with additional security features, such as identification of students through the firewall and IP- Address in our Labs.

2. Student's Perception of an Online Exam within the Decision Support System Course, Al al Bayt University [4]. The aim of this study is to measure students' perception of the use of an online exam as an assessment tool on university campus within a Decision Support System Course at Al al Bayt University. The study shows the advantages and disadvantages of the use of an online exam on the university campus. To do so a questionnaire was delivered to students taking the course and then it was analyzed using the SPSS. The results showed that there was a positive perception towards the adoption of an online exam

3. Previously proposed “Challenges of Online Exam, Performances and problems for Online University Exam” [5]. In this research paper, they proposed a system that authors provides a strong security in order to improve on-line examination by utilizing technologies such as biometric authentication, internet-firewall, cryptography, network protocol and object oriented paradigms. Furthermore. They conclude that by improving the security system using biometrics face recognition that can be incorporated into the proposed system will fulfill the criteria for a successful online exam taking.

4. “E- Exams System for Nigerian Universities with Emphasis on Security and Result Integrity” reach paper examined the impacts, associated challenges and security lapses of the existing electronic-examination system with the aim of ameliorating and developing a new acceptable e-Exam system that takes care of the existing system’s challenges and security lapses [6].

5. A measurement student Perception in Al al Bayt University for using online exam system to one course (D.S.S) were explained in a research paper by distributing a a questionnaire among the students who took the online exam. The result showed there was a positive insight to accept the online exam courses. [7]

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Methodology

The main purpose of the research paper is to provide a fully automated Online Exam System that can capture, collate and analyze the data and evaluate the impact of the program. The system will allow access only to authorized users with specific roles (Administrator- maintains the website, Institutes-Register to conduct the exams, Students- Give the exams online).

It will be challenging to develop an efficient Online Exam System that is capable of assessing different courses that are offered at higher education institutions including Sur University College. I aim to develop a fully secured examination system that would negate deceptive activities by the examiners and/or examinees. Equally, my goal is to provide a smooth and stress-free exam environment for students and the academic staff different from the traditional.

I as author and Online Exam System investigator, I set a team consist of me and a professional programmer who's working as Head of programmers at SUC to run the system. Mr. Hamdan Jaafreh made the programming sections under Oracle and Java application.

Online Exam System Scope

1. On-line Exam Systems are designed for middle and higher Educational Institutions.
2. These systems performs all the operations, and generates reports as soon as the exams are completed, that includes Student's Name, Student's Mark, time spent on each task.
3. These Systems allows students to see their marks immediately upon completion of the exam.
4. Possible task in such systems include: MCQs, True and False statements, filling in the blanks, Graph description, etc. along with audio/video files that can be used by the English Department for the assessment of listening skills.

Context Diagram for Online Exam System

Figure 1 represents the bounders and scope of the proposed research project. It describes the main objective of the Online Examination system and its entities.

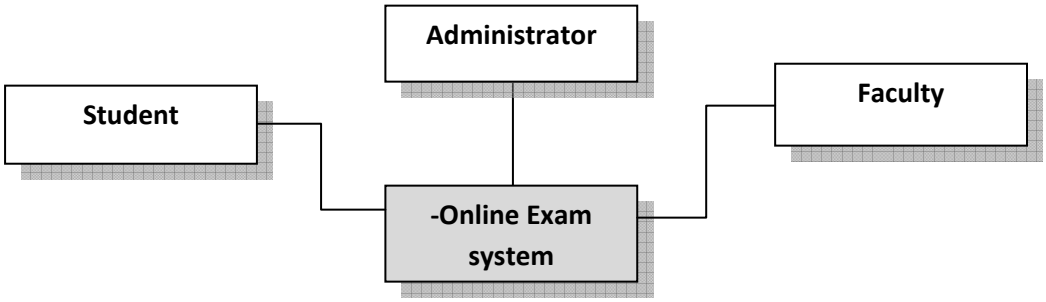

Figure1: Context diagram of the proposed Online Exam System

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Online Examination System functions Diagram

Figure 2 represents the main functions for each of the users that use the Online Exam System.

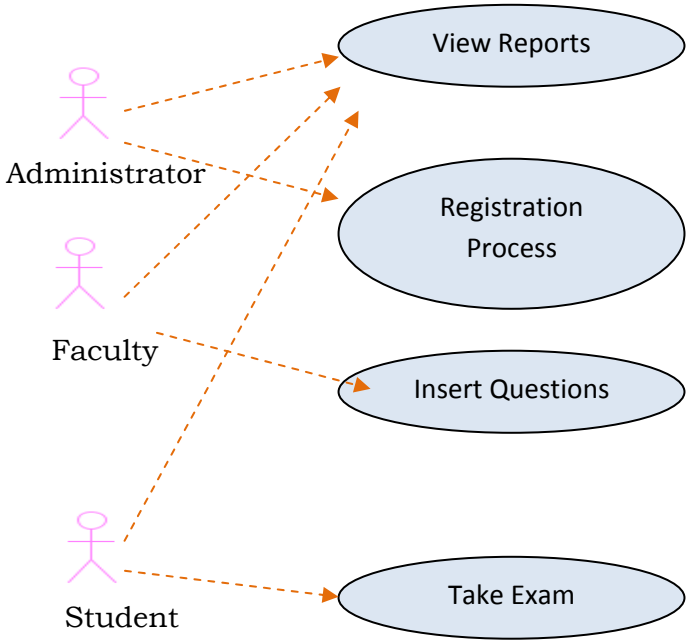

Figure2: User Case Diagram for Online Exam System

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Approach for Online Exam System.

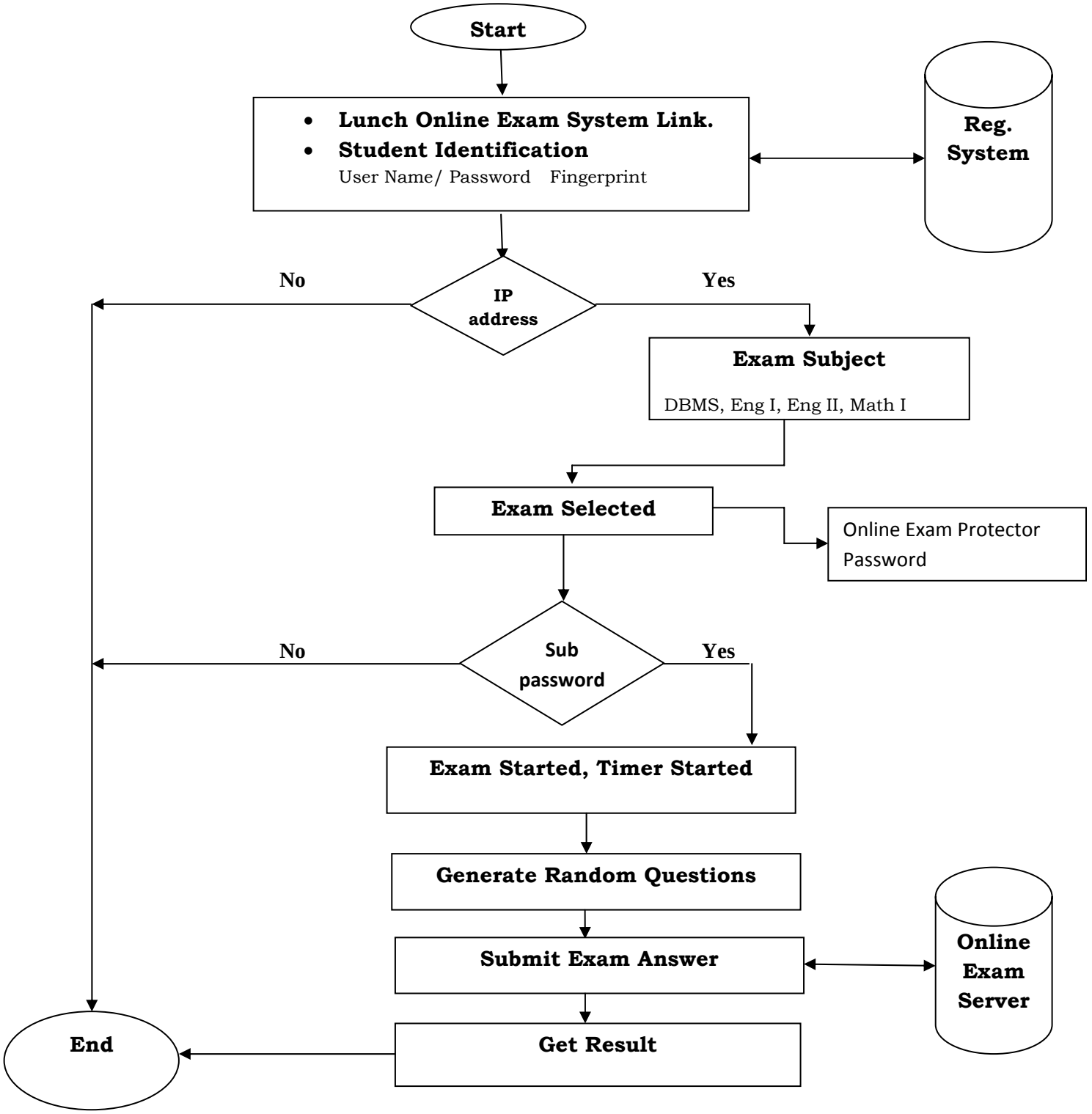

Figure 3: Flowchart of Online Exam System Approach

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Step 1: Student Identification
The Student will open the Link from college website and choose Online Exam System; Students will login into System by the user name and password that provided from registration department. The system will check the student identity through the fingerprint before entering the exam.

Step 2: Environment Identification
The system will make main check for the IP address when the student finished entering the User Name and Password. If the Computer is belong to one of IP addresses that stored in the server then the student can enter to the exam. Otherwise the user cannot enter to exam.

Step 3: Choose Exam
The Student will choose the exam from Alternative Exams that might appear. Special check if the student registered in the course.

Step 4: Exam Identification
The protector in the lab will provide the student by a random password that gets it from the system to allow the students to begin the exam.

Step 5: Exam Session Begin and Exam start
System generate random questions (True/False), Multiple Choice, fill in the blanks, etc … are given to the students from server side. Timer will start to begin the exam.

Step 6: Online Data Package
Student will answer question, each answer submitted from student will send back from client side into server side and saved into student Exam-log-file that created for each student to save his / her answers.

Step 7: Result.
When student submit END Exam, and after accept agreement from verification message to finish the exam, the system will check the student log-file answers and send back the mark to student.

Step 8: End.

Online Exam System Implementation

1- Online Exam system Directions

The Online Exam System has three sections and will take approximately 60 minutes to finish.

If the student need to stop his exam, he will click to the **Save** button at the (top/bottom) (right/left) of your screen. The answers will be saved, and the next time Student log in with his/her password and student ID number, then the student will continue the exam.

In the **Grammar** section, Student will answer 24 multiple-choice questions.

In the Reading section, Student will read one passage and answer 8 questions.

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In the Listening section, Student will listen to a talk, and then answer 8 questions.

When student finish all three sections, then student can see the score.

When students are ready to begin the Exam, They will click on the Start button at the (top/bottom) (right/left).

A clock at the top of the screen will show students how much time you have remaining.

2- Online Exam System specification.

A. Student Specification:

- The team installed the important software and updated them to run ("Online Examination system application") in the Labs; initially the computer labs on the IT building are use.
- The programmer checked the IP Address on all PC's and prevent any students or users from accessing the course exam application from an unauthorized place.
- Students chose the link of Online Exam System from the college website.
- Students Logged into Online Examination System, The system will ask students to sign in using their academic number as a user name and civil _ID as a password as shown in Figure 4.

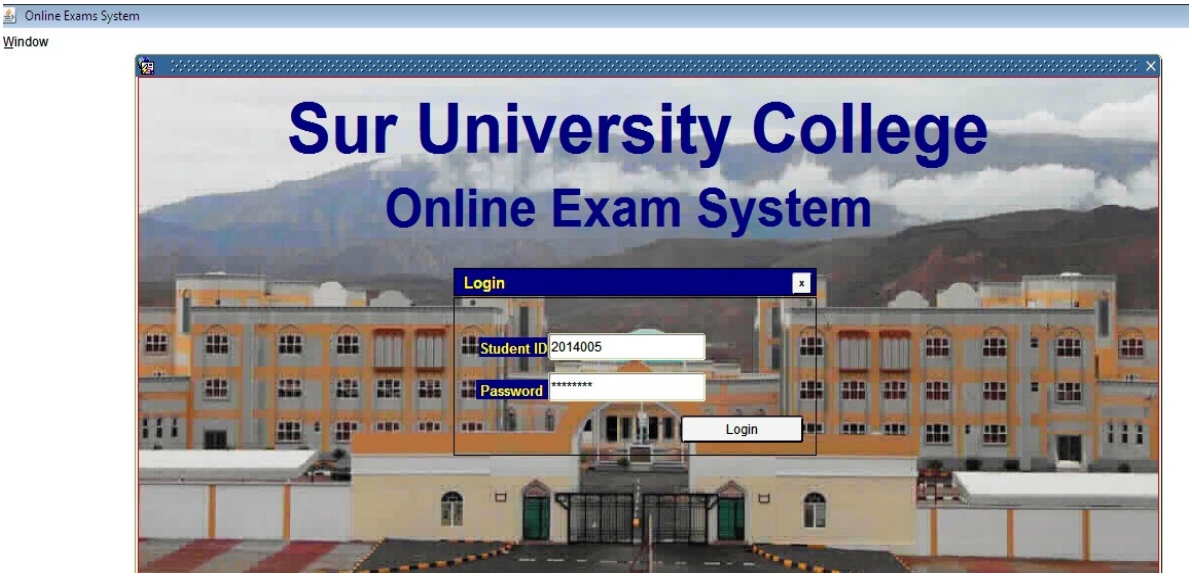

Figure 4 Login to Online Exam System

- Main screen will appear to students, and then students will select the right exam according to their courses and enter the Exam Password (will be provided by the supervisor-invigilator) to start the Course Exam. Online Exam system makes necessary validations to accept the students and check if students are registered in the course or not.
- Upon a successful login, the Exam Session and Exam Course Timer will start simultaneously, and allow the students to start answering exam questions for a limited period of time (60 Minutes or upon the Instructor opinion).

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- During the exam process individual course exams will generate specific questions (prepared by the course instructors, edited by the team for format relevancy), such as True / False Questions, Gap-fill questions, etc. …
- Students are allowed to go back to previous questions and have a chance to change their answers if needed before pressing the final SUBMIT button.
- Conduction of Listening Sections (English Courses Exams) will be as follows: A Team representative will upload audio files provided by course instructors in the server. Students themselves will operate/play the audio file upon their needs (NOT more than twice).
- Upon completion of the course exam, students must SUBMIT their answers by clicking a SUBMIT button, after that, students cannot redo the exam and/or change any answers.
- Online Examination System will calculate and show students' grades immediately after submitting the answer.
- After the total score appears on the screen, the Exam Session will close and the System will not allow any student to repeat the exam. (Students who wish to see which answers were correct/wrong can apply for permission in a registrar's office. Each student's answers will be saved in the system (server log file).

B. Client Specification:

- P.C operating system should be Microsoft Windows XP 32bit, Vista 32/64bit or Windows 7 32/64bit.
- P.C Language English/US Localization or Oman Localization only ,Minimum 512 MB RAM
- Browser is internet explorer 7 or Firefox Mozilla V 37.0.2
- JVM (Java Virtual Machine) V JRE 1.8 Recommended
- Minimum Client Resolution is 1024x600

C. Instructor Specification:

- One of the Online Examination System users is the Coordinator. The head of department will assign one coordinator for each course in the department, Head of department appoint authorize Coordinators to write a set of questions and fill in an Online Exam Question Form and upload the Exam Course Questions in the system. (Coordinator will upload the Exam Course Questions directly in the server).
- To ensure all course exams are standardized in terms of instructions and wording of individual question, the proofread and edit exam questions provided by instructors/coordinators will sent to the head of foundation programme. Upon the final approval of exam questions the will be ready to use.
- Instructors of three and fewer sections courses have the ability to login to the Online Examination system to upload their exam questions.

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- When the Coordinator/Instructor session starts, the coordinator/instructor can upload and modify his questions and must save them by pressing a SAVE QUESTIONS button in the log file (with the date and time that he/she logged in).
- Instructor / Coordinator Online Examination Course Exam Form

Question Type	Question formula	Answer 1	Answer 2	Answer 3	Answer 4	Correct Answer

- Instructor / Coordinator will login to the Online Examination system through a shortcut application. A user name and a password will be provided by the team.
- Instructor / Coordinator will save the exam course questions, and since this moment is responsible for the security of exam questions.
- Instructor / Coordinator will set the time and the date of his/her course exam and will also allocate the venue.
- Instructor/Coordinators Exam Session ends when he/she sets the due and the venue of the online exam.

D. Administration Specification

- Administration users (dean, registrar, HOD) are the person who can access to the System by a unique username and a password to view the grades after students attend the exam.
- Online examination system will automatically move all students' grades into the Instructor section form.
- Administration users can request various statistical reports about students' absenteeism / attendance, etc. Administration users can also printout the answer sheets for any student if required.

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I would like to thank the management of Sur University College for the financial and moral support and the fund in conducting this research. Also I would like to thank the Dean and Assistant dean for administration affairs at Sur University College for their motivation toward doing this research.

Conclusions

1- I aim to provide a tool for conducting online examination that saves time for all members of the examination process (pre-exam arrangements as well as post-exam administrative work as the scores are automatically generated by the server.

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2- More security exam using biometric devices such as fingerprint for identifying students.

3- More accuracy compared to current system that used a customized MOODLE and new system will allow only specific computers to participate running the exam by detecting IP address.

4- I applied the Online Exam System as a case study to Sur University College.

5- I aim offer this project upon a successful trial execution to a Sur University College – Sultanate of Oman – Sur.

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A Brief Author Biography

Mohammad A Sarrayrih

Mr. Sarrayrih has MSc holder since 2004 and Bachelor in CS -1999 graduate of the Faculty of Science, Mutah University. At the present time Mr. Sarrayrih teaching Information systems and technology courses for both of diploma and bachelor degree in SUC, and success to publish more than four research papers in Online learning in international journals.

Android Based Optical Character Recognition for Noisy Document Images

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[2] COMSATS Institute of Information Technology, Islamabad

Abstract

This paper presents the research on OCR (Optical Character Recognition) of English and numerical in noisy printed document images for android mobile. The objective of this paper is to develop an android based solution of current problem and to reduce its complexity to make its implementation lighter and less memory consuming. For this purpose we divided our task into two parts i.e., segmentation and recognition. The innovative feature of proposed approach is that we treated noise and printed text as a separate class. We considered three kinds of noises for testing of system i.e., Salt and Pepper Noise, Monochromatic Uniform Noise and Monochromatic Gaussian Noise. Our developed algorithm can automatically locate the textual regions in the noisy input image. The optical character recognizer then applied to only those regions of the image which contain text. Trained classifier is used to recognize printed text from noise input image. Experimental results show that our approach is robust to light variation and can significantly improve page segmentation and recognition in noisy document collections. Moreover, the proposed approach is the first initiative as there is no such solution available till date which can perform OCR on android mobile remotely

1. Introduction

Optical Character Recognition (OCR) [1] is a process of translation by which we can convert printed document or scanned page into ASCII characters which can be recognized by computer. David Sheppard in early 1950s issued U.S. Patent for “Gismo” It was the first machine with the ability to convert printed material into machine language. Further He founded the Intelligent Machines Research Corporation (IMR), which produced the first OCR systems for commercial operation. Reader's Digest installed the first commercial system in 1955. The United States Postal Service has been using OCR machines to sort mail since 1965.

OCR technology now a days, integrates the complex computer algorithms and high speed scanners to increase speed and data accuracy. Current OCR systems do not require training to read a specific font. These systems can recognize the majority of fonts with high precision. Some are even capable of outputting formatted text that closely approximates the printed page. The Recognition of printed characters is a challenging problem because of variation in same characters in terms of fonts, sizes and introduction of different types of noises. The difference in fonts and sizes also effect the feature extraction process hence ultimately makes recognition task difficult.

In this paper, we present a technique to develop complete OCR system that can be trained for any font and size. We also implemented phases of the OCR system like segmentation of input document image, feature extraction, forming a training dataset and classification. The proposed system identify and analyze a document image by dividing the page into line elements, further sub-dividing into words, and then into characters. These characters are compared with image patterns to predict the probable characters.

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1.1. Related work

We have analyzed related work which has been done before in the form of android based application and we come to know that all the features that are already being provided by below mentioned existing applications restrict the user to some extent. Analysis is shown in the form of table below.

Application	Features		
	Efficient	Server Independent	Freeware
ABBYY Fine Reader	✓	✓	x
OCR Test	x	x	✓
mOCRa	x	x	✓
Book Speech	x	x	✓

Table 1: Analysis Summary

To overcome the drawbacks of above mentioned solutions the following method is proposed.

2. Proposed method

To achieve the accuracy of optical character recognition (OCR) [1] in printed document image for android mobile, very basic idea is used for the said task known as blob. The method is reported as robust enough to deal with the highest degree of noise ranges from 0-90 percent. The method is intended at identifying points or regions in the image that is different in properties like brightness or color, compared to the surrounding. The method have two main divisions of blob detections, first is known as differential methods based on derivative expressions and second is known as based on local extrema in the intensity landscape. In recent terminology these operators also known as interest point operators or alternatively interest region operators.

For the purpose of blob detection Laplacian of the Gaussian (LoG) [8] method is used. Where input image is f(x,y) which is convolved by a Gaussian kernel:

$$g(x,y,t) = \frac{1}{2\pi t} e^{-(x^2+y^2)/(2t)}$$

At a certain scale 't' to give a scale-space representation:

$$L(x,y;t) = g(x,y,t) * f(x,y)$$

Then, the Laplacian operator:

$$\nabla^2 L = L_{xx} + L_{yy}$$

A simple way to get multi-scale blob detector with automatic scale selection is to consider the scale-normalized Laplacian operator:

$$\nabla^2_{norm} L(x,y;t) = t(L_{xx} + L_{yy})$$

Thus interested point is known as:

$$(\hat{x},\hat{y};\hat{t}) = \mathrm{argmaxminlocal}_{(x,y;t)}(\nabla^2_{norm} L(x,y;t))$$

For the learning part a printed document image is provided to the algorithm having English and numeric characters is shown below. Above mentioned method is applied to image to recognize characters and treated every single character is self as a blob; moreover a valid ASCI value is assigned to every blob.

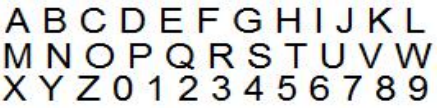

Figure 1: Learning Input Image

For the testing part printed document images are provided to test the proposed method having no noise or 0-90 percent noise of Salt and pepper, Monochromatic Uniform and Monochromatic Gaussian types.

2.1. Experimental Results

Percentage Noise	Noise Type		
	A	B	C
0	98.73%	98.90%	99.80%
10	98.73%	98.72%	99.61%
20	98.98%	98.36%	98.67%

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30	98.73%	96.36%	97.90%
40	98.47%	93.27%	92.76%
50	98.98%	X	X
60	98.22%	X	X
70	97.96%	X	X
80	96.70%	X	X
90	94.92%	X	X

A: Salt and Pepper
B: Monochromatic Uniform
C: Monochromatic Gaussian

Table 2: Experiment results with/without noise

To check the accuracy and robustness of above stated method for android mobile, evaluation on large amount of printed document images is been performed. Testing is performed in two parts; in first part algorithm is tested on printed document images having no noise whereas in the other part of testing is performed on noisy images. Three types of noises are considered for the testing and the intensity of noise is ranges from 0-90 percent, results are stated above.

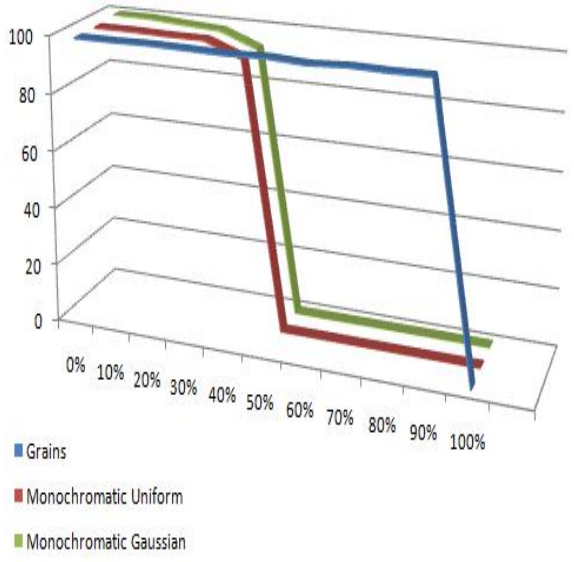

Figure 5: Experiment result's graph

Salt and pepper Noise [2] is a form of noise usually seen on images. It represents itself as randomly occurring white pixels in a black area and black pixels in a white area [5].

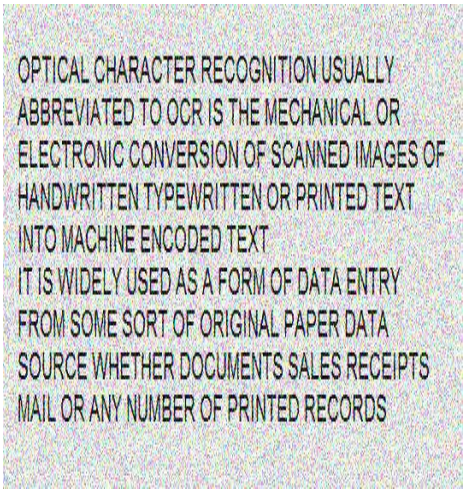

Figure 2: Salt and pepper noisy, text documentimage, up to 90%

Monochromatic Uniform Noise [3] is form of noise which is caused by quantizing pixels of a sensed image to number of discrete levels known as quantization noise. It has almost uniform distribution, and can be signal dependent. But this noise can be signal independent if other noise sources are large enough to cause dithering or dithering is explicitly applied [6].

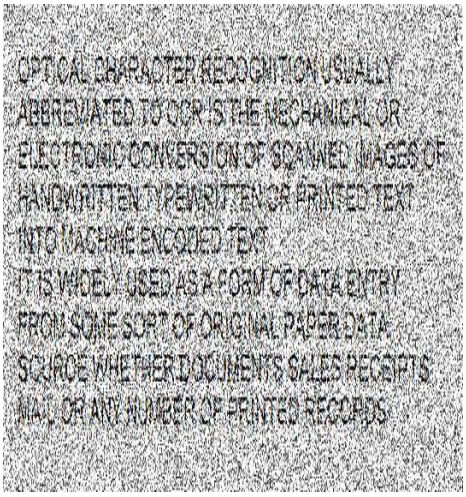

Figure 3: Monochromatic uniform noisy, text document image, up to 90%

Monochromatic Gaussian Noise [4] is a statistical noise in an image that has its probability density function equal to the normal distribution. This distribution is also known as Gaussian distribution. The noise will be

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called as white Gaussian noise when the values at any pairs of times are statistically independent and uncorrelated [7].

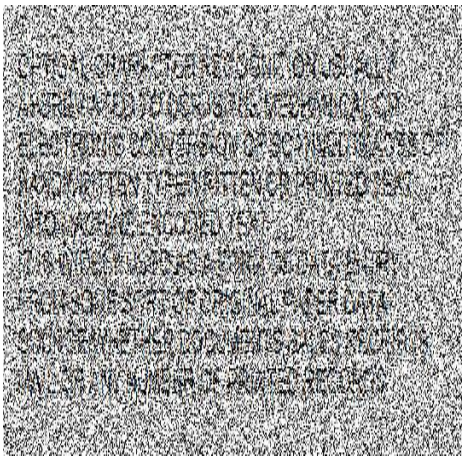

Figure 3: Monochromatic Gaussian noisy, text document image, up to 90%

3. Conclusion

For certain types of noisy printed document image, OCR technology provides fast, automated text capture. There are many factors that affect the performance of OCR system. The recognition rate of OCR system with the printed image document of proposed method is quite high as shown in the output. A lot of research work exists in the survey for optical character recognition. However, still there is a room for accuracy and less memory consuming solution.

In this paper, we have presented the solution for optical character recognition (OCR) in printed document image with considerably improved accuracy in various noisy environments and less memory consuming. Our proposed approach uses minimal character set, however it is not specified for different writing styles and font size issues. The following key challenges can be further covered by adding those in training data.

4. Future work

In future work we consider improving current solution which although works really well for non-noisy text input images but the need is to improve it for some noisy text input image ranges from 50-90 percent noise which is marked as ‘X’ in table 1 because of memory overflow in Monochromatic Uniform and Monochromatic Gaussian noisy environment.

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A Cloud based GIS Application framework to Analyze Road Accidents using windows azure

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***Abstract*— Cloud computing is rapidly evolving technology allowing its users to rent data centre capabilities according to their requirements. It also allows them to instantaneously scale up or scale down the rented capability as per their need. Even not fully evolved, cloud computing can accommodate a wide range of applications and deliver a variety of services. A system which integrates geospatial data with descriptive data is called geographical information system (GIS). Web based application over the cloud are becoming very popular and web based geographical information systems applications are also very useful and in need. This report performs a critical analysis of available and possible use of technology for a project that requires combination of Cloud computing and web based GIS application to achieve its objectives. It also encompasses design and implementation of a cloud based GIS application to analyse road traffic accidents in Cloud Based GIS to Analyse Road Accidents.**

***Index Terms*— Cloud Computing, Geographical Information Systems, Road accident, Windows Azure.**

I. INTRODUCTION

As organizations those are hugely dependent on IT such as Amazon and Ebay, scale up, their IT infrastructure becomes more complex and running costs also climbs up as keeping and maintaining a large Data Centre and IT based operation is very costly business. In most cases, these organizations don't require the same IT provisions throughout the year. Their IT provisions requirements is highest during busy times such as Eid, New Year and right after these events it goes very low. The point I am trying to make is most of the businesses need to acquire and maintain IT provisions which they don't really use constantly throughout the year and most of it is wasted during the quiet business times. This means unnecessary costs for the business, its other impacts can be environmental pollution, waste of energy resources and manpower, and all these things affect the business scalability.

Large scale GIS (Geographical Information Systems) [1] are slow to build as acquiring statistical and geospatial data is very time consuming process. Usually, most GIS systems are built by using modular approach. For example, to develop an address locator application for a city, a digital map of the city need to be created, which means building a database of locations' addresses of the city map and then use this database to implement the system.

If such a system is required for a country or for the world then map digitization and data collection may take years. But before implementing such a system, developers need to estimate the type and numbers of users and infrastructure required to run the system. Then a fix IT infrastructure for the system needs to be built. If the number of users or database size increases then infrastructure also needs to scale up to accommodate the load which is technically difficult, costly and time consuming.

If such a system is built over a cloud then scalability is not a problem at all. Cloud elasticity allows the developers to acquire as many servers as required instantly from the cloud. According to Amazon EC2 [2], reduces the time required to obtain and boot new server instances to minutes, allowing you to quickly scale capacity, both up and down, as your computing requirements change. This instantly increases the processing power without affecting the service too much and when not required, those servers can be returned back to the cloud.

1.1 Cloud Computing

Fundamentally, cloud computing [3] is not a new paradigm. It is actually evolved from already existing technologies such as

- Utility computing
- Distributed Computing
- Centralized data centers

But the uniqueness lies in its simplicity, it promises that every small or large business or consumer get IT services in a very simple way. It is still an evolving paradigm and after carefully going through various books, research papers and journals I realized that there is no standard definition of Cloud computing.

Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model promotes availability and is composed of five essential characteristics, three service models [5], and four deployment models.

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1.1.1 Essential Characteristics:

- On-demand self-service
- Broad network access
- Resource pooling
- Rapid elasticity
- Measured Service

1.1.2 Service models:

NIST definition [6] of cloud computing also describers its three well accepted service models as these are shown in Figure 1.

- Software as a Service (SaaS)
- Platform as a Service (PaaS)
- Infrastructure as a Service (IaaS)

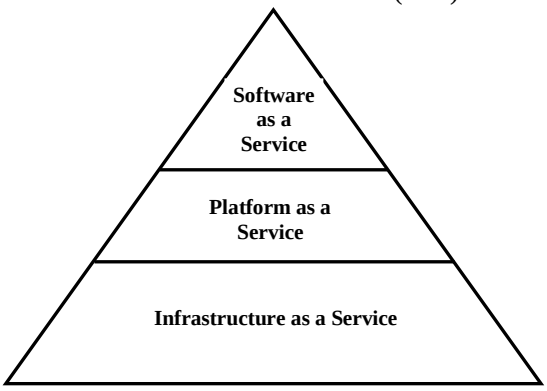

Figure 1: Cloud service models

1.1.3 Deployment Models:

Deployment models for clouds are shown in figure 2 and these are of following types.

- Private cloud
- Community cloud
- Public cloud
- Hybrid cloud

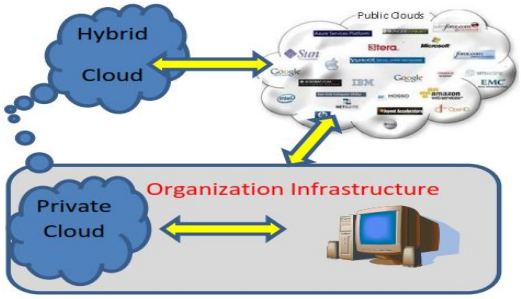

Figure 2: Type of Clouds [7]

Although there are so many cloud service providers but Amazon, Microsoft and Google are few of the largest and bests. We choose Microsoft Windows Azure [4] as cloud platform.

1.2 Microsoft Windows Azure

Microsoft Azure is Microsoft's Platform as a service. (Azure) [5] According to Microsoft, Windows Azure provides developers with on-demand compute, storage, networking and content delivery capabilities to host, scale and manages Web applications on the Internet through Microsoft data centres. Windows Azure serves as the development, service hosting and service management environment for the Windows Azure platform. Windows Azure is now commercially available in 40 countries.

(CHAPPELL, October 2010) [11] Microsoft describes its purpose as, "Rather than providing software that Microsoft customers can install and run themselves on their own computers, Windows Azure today is a service: Customers use it to run applications and store data on Internet-accessible machines owned by Microsoft. Those applications might provide services to businesses, to consumers, or both."

"It allows applications based on Microsoft Technologies to be hosted and run from Microsoft Data Centers. Its Fabric Controller automatically manages resources, balances loads, replicates for resilience and manages the application lifecycle"

The best development environment with azure is the Visual studio and Microsoft has developed additional software development kit & tools for the cloud applications. To some level, Windows Azure supports popular standards, protocols and languages including SOAP, REST, XML, Java, PHP and Ruby, but best support is available for Microsoft technology such as Visual Basic, C#.Net and etc. After installing the Windows Azure SDK and Windows Azure Tools for Microsoft Visual Studio, Cloud Services solution templates will appear for cloud based projects, they are similar to Microsoft Web Application Projects but specifically tailored for Microsoft Azure. Microsoft also provides comprehensive video and lab based tutorials for new Azure developers. Windows Azure has five main parts Compute, Storage, the Fabric Controller, the CDN, and Connect.

1.2.1 Computer: Runs applications in the cloud. Those applications largely see a Windows Server environment, although the Windows Azure programming model isn't exactly the same as the on-premises Windows Server model.

1.2.2 Storage: Stores binary and structured data in the cloud.

1.2.3 Fabric Controller: Deploys, manages, and monitors applications. The fabric controller also handles updates to system software throughout the platform.

1.2.4 Content Delivery Network (CDN): Speeds up global access to binary data in Windows Azure storage by maintaining cached copies of that data around the world.

1.2.5 Connect: Allows creating IP-level connections between on-premises computers and Windows Azure applications.

According to Microsoft, SQL Azure is a highly available and scalable cloud database service built on SQL Server technologies. SQL provides all the normal SQL server features over the cloud which includes, creates, accesses, and manipulate tables, views, indexes, roles, stored procedures, triggers, and functions, complex multi table join queries, insert, update and delete, constraints, transactions, temporary tables, some built in stored procedures and system views and etc. As it is available on Microsoft Azure PaaS, which means installing managing and maintaining is not users' responsibility, Microsoft maintains it and runs it over its own data centers. It terms programmability support ADO.net, ODBC and PHP.

Following features ensure Microsoft's datacenter infrastructures' security, continuity, and privacy

- Controlled privileges to Microsoft Operations personnel
- Microsoft security response Centre
- Network Administration
- Physical Security

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II. Related Work

In these days wireless and mobile technologies are increasing day by day with advanced technologies and equipment. Most of the modern vehicles are equipped with smart phones and sensor devices.

A V-track system is used for energy efficiency and sensor reliability. They are using hidden Markov model to estimate travel time but it has some global issues. Ron et al. [8] used a sub-Layers based novel navigation architecture for vehicles. This Intermediate system elaborates the operations like observation, localization, mapping, and tracking etc. they used a smart car sensor network framework based on OSGi and AMI-C Standards. Jabar et al. [7] discuss the issues of traffic in gulf area, which shows high death rate in this area due to huge traffic. They proposed a system for traffic handling using mobile technologies and wireless sensor with coordination of hospitals and recue service. Ahmed et al. [9] proposed a cloud computing model for emergency services based on GIS. It discusses emergency system for earth quake prediction and earthquake situation. This system can provide some good result for local scenarios.

2.1 Geographical Information Systems

A Geographic Information System (GIS) [13] is a special form of information systems which integrate spatial data with descriptive data. According to ESRI.com [10] "A geographic information system (GIS) integrates hardware, software, and data for capturing, managing, analyzing, and displaying all forms of geographically referenced information". Environmental Systems Research Institute (ESRI) is considered as one of the giants in GIS research and development and according to them GIS is used in business, defence and intelligence, education, government, health and human services, mapping and charting, natural resources, public safety, transportation, utilities, communication and etc. in variety of ways. For example, Businesses maintain sales, customers, inventory, demographic profiles, and mailing lists, all of which have geographic locations. Therefore, business managers, marketing strategists, financial analysts, and professional planners increasingly rely on GIS to organize, analyze, and present their business data.

2.2 Microsoft Silverlight

Microsoft is one of the leading cloud PaaS providers. But one big issue with the Microsoft technology is the platform dependence of the web applications on their windows operating system. Microsoft has developed a tool to build interactive applications which is called Microsoft Silverlight. Microsoft defines Silverlight in following words

Microsoft Silverlight [12] is a powerful tool for creating and delivering rich Internet applications and media experiences on the Web. It also supports many popular web browsers and platforms such as Mac OS X Nokia Symbian S60. Although it only support few other platforms but this tool is a big step by the Microsoft towards platform independence.

2.3 ESRI MapIt

Considering the use and multiplatform compatibility of Silverlight ESRI took a step to build GIS development software called MapIt, [14] which should allow MapIt web based GIS application to reside on Microsoft platform and used over other platforms such as Mac OSx.

(ESRI,http://www.esri.com/software/mapit/gettingstarted/silverlight.html) According to ESRI "MapIt enables you to create rich internet applications in Silverlight that utilize the powerful mapping, geocoding, and geoprocessing capabilities provided by ArcGIS Online and Bing Map services". There are plenty of case studies and sample applications available on ESRI.com

In a publication ESRI claimed "ESRI chose to offer MapIt as a cloud solution with the Windows Azure platform because it offers a short ramp-up-time and familiar technologies that customers were used to working with in their own IT environments" It is also mentioned in the same publication "ESRI chose Windows Azure to take advantage of its easy interoperability with other Microsoft software and services such as Microsoft SQL Azure"

2.4 Research Niche

In light of above literature review it can be concluded that building a GIS system is possible, it can be built on IaaS or PaaS and this could be a viable solution for the organizations because of the following reasons

- Renting the infrastructure and platform services from cloud reduce responsibility and let them focus on their specialist work
- It will have financial benefits as cloud infrastructure and platform is cheaper than dedicated Infrastructure and platform
- Improve reliability as true and experienced IT professional organizations manage and maintain the infrastructure and platform
- Scalability can no longer be a big problem due to cloud provision elasticity
- Organizations can reduce their carbon footprint by more efficient use of infrastructure resources

Also, cheaper services mean more and more organizations will take step towards the advance technology which will improve their business.

III. Proposed Solution

Figure 3 shows how the aim and objectives of this project has been achieved by using Microsoft Azure PaaS. A SQL azure database has been be built to store Road Traffic Accident Data. A Microsoft Silverlight interactive application is built by using Visual Studio 2010 [20]. This application is based on a Silverlight project, a web project and a Windows Azure Project. The Azure Project is used to manage cloud related issues such as roles, instances and related storage accounts for the hosting service.

In the web project, an ADO. Net Entity Framework Model is used to connect to SQL Azure Database. One of the key issues to tackle here is that we cannot import SQL Azure Entities which use SQL spatial data types in ADO. Net Entity Framework Model.

To overcome this problem, for all database entities those use spatial data types, Views are created to convert data type of

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attributes with SQL Geometry data type into Well Known Text Format. After that, these views are imported in Entity Framework Model of Web Project. Here WCF-RIA Domain services defined in Web Project allow Silverlight application running on the client to access entities of Entity Framework Model.

Another very important issue is displaying the WKT geometry over Silverlight Bing Map control. There is no way of directly converting a WKT geometry representation into Bing Map geometry. To overcome this problem, a Function is created which takes a WKT representation of Polygon and returns a Bing map polygon, another function takes WKT representation of point/Location and returns a Bing Map Location object. After that these, object are added in relevant layers and displayed on the Bing map control.

3.1 System Operation

Figure 3 depicts the work process of the system. It is clear from the Figure that Database resides on a SQL Azure server in the cloud, System's Web Application reside on a web server in the cloud.

3.1.1 Client

Client is a computer with either MAC OSx or Windows XX OS. Also it should have a browser with Microsoft Silverlight Plugin Installed.

3.1.2 App Fabric

App Fabric is cloud middleware platform for developing, deploying and managing applications on windows azure platform. It is responsible for creating and managing Web Role instances, load balancing, secure connectivity to the web server.

3.1.3 Web Role

Web Role represents a web server which hosts the web application of the system. It has IIS and all necessary installed APIs which are required by the hosting app.

3.1.4 Storage Account

Storage account is used to provide storage for the web role where the actual web applications are stored. In this project only blob type storage is used as only binary data is used to store application files.

3.1.5 WCF RIA Domain Services

WCF RIA domain services provide data access to the Silverlight client according to the application logic running on the web server. In simple words, it allows the Silverlight app on the client to interact with SQL azure database in a controlled and secured way.

It is clearly depicted in Figure 3 that the process begins with client, when it sends an http request for the application web page to the Web server. The server responds and send asp web page to the client which has a Silverlight object embedded in it.

Now the client browser displays the page on the screen, whereas, Silverlight part of the page is executed by Silverlight plugin of the client browser. After that if the user does something in the Silverlight app which requires something to do with the database, the Silverlight plugin sends a LINQ query to the web server via a specific domain service. Now on the web server's WCF RIA [17] Domain service translates this LINQ query into SQL Query and send it to SQL Azure sever [18] via ADO.Net Entity Framework Model.

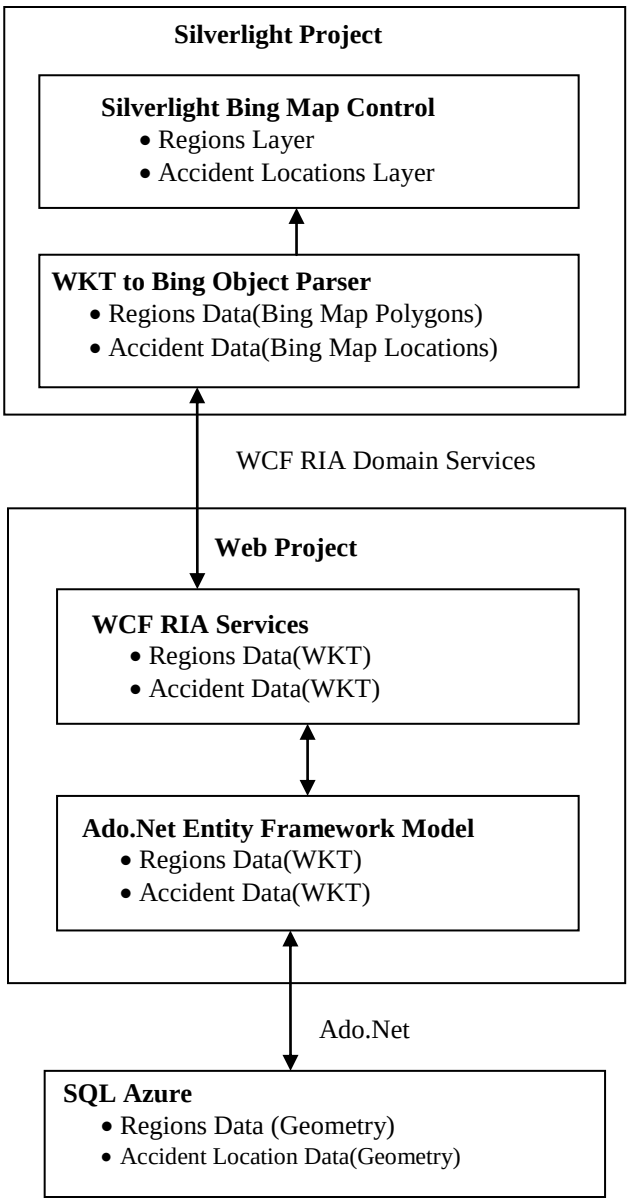

Figure 3: Spatial Data representation in the project

SQL Azure server executes this query and returns the results to ADO.Net Entity Framework Model on the Web Server which then passes the results to domain service. Now domain service passes the results to the client's Silverlight plugin as I Enumerable of the resultant Entity Framework Model Entity Object, which Silverlight application used to manipulate resultant data.

3.2 Tools and techniques

Following are the tools required to build the system

3.2.1 Visual Studio

Visual studio is used in Integrated Development Environment for building the system. One of the main reasons for using Visual studio 2010 [16] is its superior integration with Windows Azure which speeds cloud service development as it incorporates deployment and management tasks within the developer environment. It also provides state of the art

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development, debugging, and diagnostic capabilities which helps in building high quality cloud application.

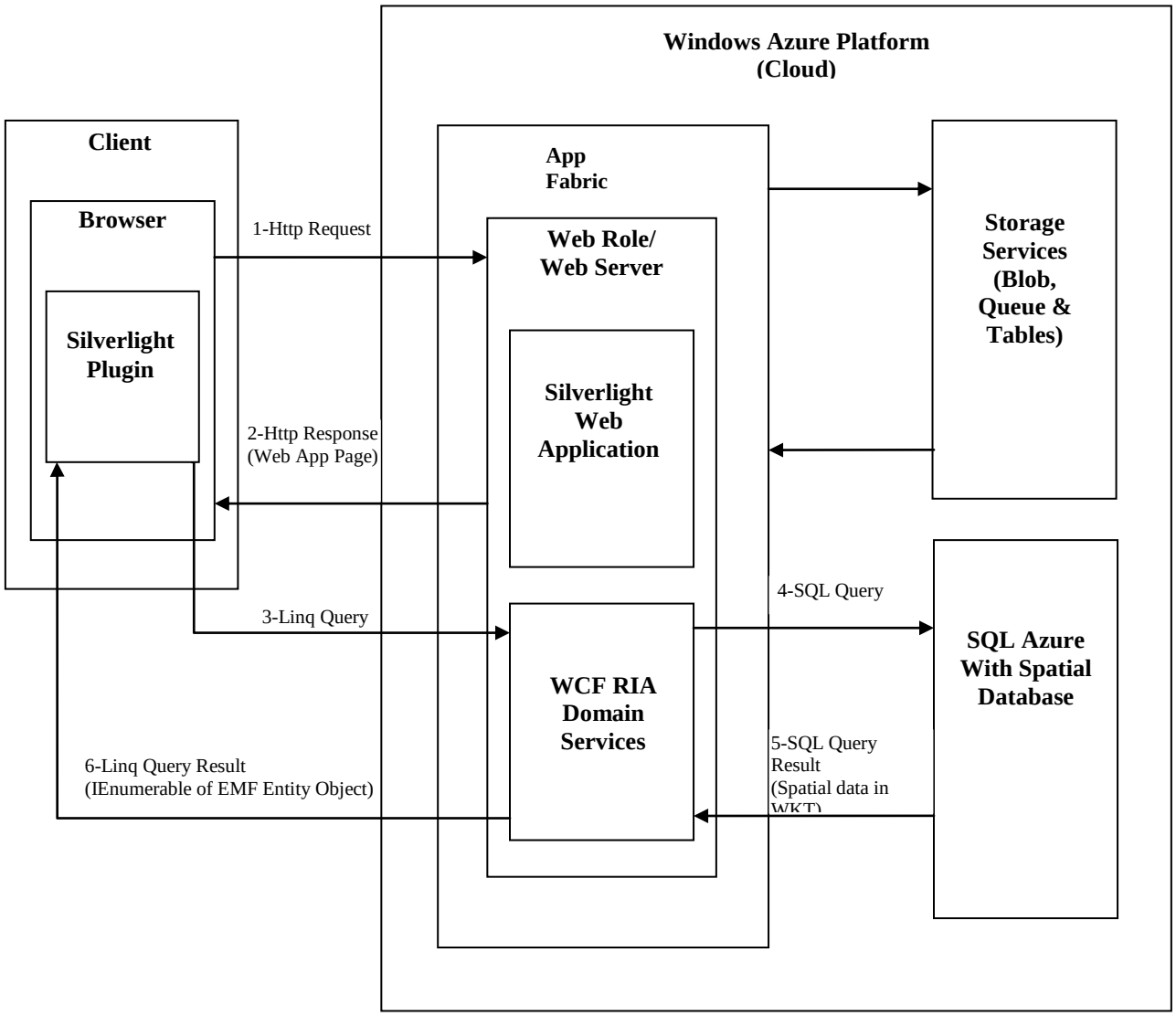

Figure 4: Work Process of System

3.2.2 Silverlight 4 SDK

Microsoft Silverlight 4 Software Development Kit is used which contains libraries and tools for developing Silverlight 4 applications. This toolkit include following components required to develop and run Silverlight applications

- Silverlight 4 developer runtime
- Silverlight 4 SDK (software development kit)
- Update for Visual Studio 2010 and Visual Web Developer Express 2010 (KB982218)
- Silverlight 4 Tools for Visual Studio 2010
- WCF RIA Services V1.0 for Silverlight 4
- F# Runtime for Silverlight 4

3.2.3 WCF RIA Services

Microsoft WCF RIA Services simplifies the traditional n-tier application pattern by bringing together the ASP.NET and Silverlight platforms. RIA Services provides a pattern to write application logic that runs on the mid-tier and controls access to data for queries, changes and custom operations. It also provides end-to-end support for common tasks such as data validation, authentication and roles by integrating with Silverlight components on the client and ASP.NET on the mid-tier.

3.2.4 Bing Maps Silverlight Control SDK

This software development kit (SDK) provides the binaries and programming reference for the Bing Maps Silverlight Control. This Control will be used to display base map for the Silverlight application.

3.3 Description of accident management System

3.3.1 Accidents in a Region

It is important to mention here that how the spatial data is used in the database in the table Region, Shape attribute contain regions as geometry polygon objects. In the Accident table, Longitude and Latitude attributes of double type are used to contain the accident location coordinates.

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The reason for keeping accident location in two double type attributes instead of one geometry point is that we can't import geometry objects in Entity Framework Model and if we want to reverse-geocode the accident location to find out the accident location name such as road name these two values are required inside the Silverlight app and since we cannot import geometry data type in Entity Framework Model. Therefore it is more convenient to handle no geometry attributes inside the database.

3.3.2 Search Accident Screen

Figure 5 shows the Search Accident Screen. This screen allows the user to search the accidents and view them on the map. All the controls on the screen are common controls. For searching user there is no need to type anything, all the controls on the search pane allow the user to select only the valid options including dates and time.

Map control might appear as something new for some users but it is very easy to use. To zoom in/out user uses slider on the map. To move map user drag the map or use joy stick control on top left corner of the map. And to change the map view user clicks on any of the map view option buttons on top of the map.

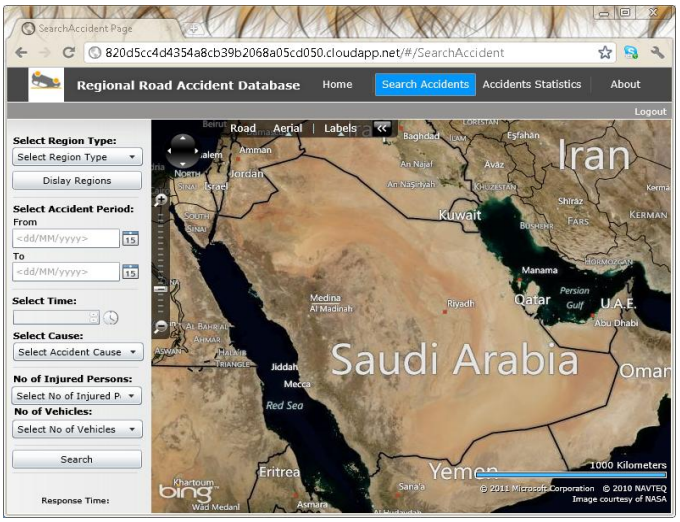

Figure 5: Search Accident Screen

3.3.3 Accidents Statistics Screen

This screen allows the user to view accidents statistics. It might look alien to some users as it uses a new type of chart called tree map which shows the percentage by the boxes. Size of the boxes is proportional to the percentage values. This approach lists the values and allows the user to quickly make a comparison. For example, in figure 5-21 by just viewing the chart and without even reading much detail a user can tell age group 31-40 was involved in most numbers of accidents as its box is largest.

IV. Performance and Evaluation

It's one of the key tests as this application will be running in a very stressful environment having a substantially large database for the system also in some cases when user will be searching for longer dates range the result may be comprised of thousands of records. Since those records will be downloaded from server and may be in Mega Bytes there is a possibility that application will crash, given that the internet speed on the client is slow or internet connection is fluctuating between connected and disconnected state.

Test this scenario about 40000 dummy records are inserted in the database and searching is performed for very large date range.

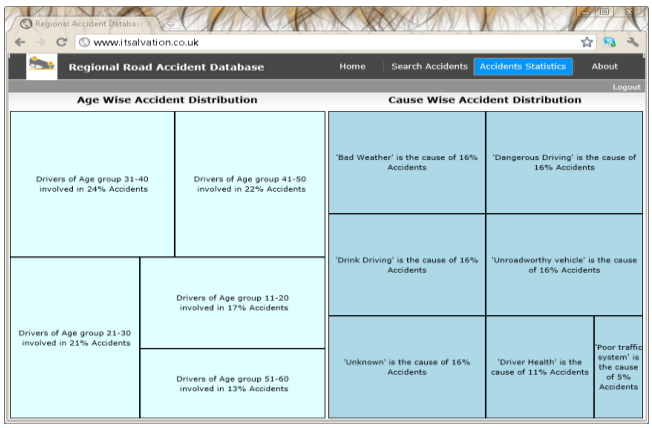

Figure 6: Accident Statistics Screen

4.1 Stress evaluation

It was observed that when the number of resultant accident records is too high for a region, such as 6000, then after application crashed and showed the error request time out. After some research it was realized that this was happening because default keep alive time for a WCF RIA service request is 1 minute and if a query response from SQL Server takes more than a minute and WCF RIA service was showing this error because it was assuming that the connection with domain service on web server is broken.

This issue is resolved by increasing the client's Domain Context object keeps alive time. Client Domain Context object consumes the WCF RIA Domain service provided by web server.

After resolving the issue this stress test is performed again with only the date range, it worked perfectly fine. But when some search conditions were applied those require the SQL Azure server to inner join multiple tables and filter through a large table containing around 150000 records and the result was large enough then sometimes application worked and sometimes it crashed. But if we apply same search condition for a medium date range of between three and four years, then it always worked perfectly. For small date range its response was exceptional.

After spending many days to identify the root of the problem I realized it has something to do with the SQL Azure Server. I increased the number of web role instances from one to three, I tried running the system from a client solely connected to the internet with 50Mbps broadband, same error keeps popping up.

The last thing I wanted to do is to scale up the hardware running the SQL Azure Server to see if increasing processing power of the SQL Azure server may help. After doing some research, I realized I can only scale up SQL Azure either by creating a portioned database on multiple servers or on a single server. I can only change the type of the database which scales up the database size and SQL Azure product between

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web and business but the actual hardware running the database will remain the same. As spatial search is very processing intensive, I strongly believe this problem can be solved by increasing the power of the machine running the SQL Azure, which unfortunately is not possible at the moment. But on the other hand, there is no need of searching all the accidents happened in last 20 years as the result would be a map region full of thousands of accident locations pins. So logically, the application is still useful if we want to find the locations and rectify traffic problems causing the accident in recent times up to a few years but if we search the accidents for ten years this will not make any sense on the map and hence serves no purpose. But technically, application should not crash in said situation and it is a weak point.

This issue could be resolved if we move from PaaS to IaaS and use most powerful servers to run SQL server and if necessary create a cluster for the SQL Azure to gain maximum performance but this will add up quite a lot of workload and cost of maintaining the servers. Hence, there is a performance trade-off for data and processing intensive application if we move on from IaaS to PaaS.

Accident statistics page works perfectly fine for any data size.

4.2 User Acceptance

The application is demonstrated to few non-computer expert common people and the only objection was on the search accident page. They think instead of a single time field there should be a range of time, as in most cases people don't know the exact time of accident and hence if we search on absolute time value we may end up with no result.

V. Conclusion

Based on of above evaluation & testing I could say that the system meets all of its objectives and it can serve the aim of helping quickly to find dangerous roads accidents and implement accident prevention measures. It also helps to identify which age groups cause most of the accidents so the Law enforcement authorities take extra care when dealing with people of that age group. It also helps to identify what are the main causes of accidents, and decide which should be on the highest priority in the road safety planning.

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Application of Particle Swarm Optimization to Solve Transportation Problem

Barileé Barisi Baridam and Chika Linda Nnamani

***Abstract*—Effective transportation involves an efficient and faster connection to a destination. In other to solve the problem of finding the shortest distance in a transportation network, many optimization methods have been applied to transportation system. PSO is one of the recent Bio-inspired optimization methods that are used in solving many optimization problems. There are various methods of solving optimization problem in transportation system which includes the canonical methods, the bio-inspired methods, and other methods. PSO algorithm is applied in various areas including the optimization of a transportation network. Detailed analysis of the basic PSO algorithm is presented. PSO is used in this work to solve transportation problem (i.e. to optimize the distance) by finding the shortest path in a given transportation network. This PSO algorithm is applied in transportation network with many connections and the shortest distance was found. The procedure includes changing the velocity as well as position by generating a new objective function which is achieved by computing the shortest distance between two points using the Cartesian distance formula. The shortest distance was found considering all the possible routes within the network.**

***Index Terms*—PSO, Optimization, Transportation, Traveling Salesman, Distance metrics, Minimum Spanning Tree.**

I. Introduction

The use of particle swarm optimization (PSO) is one of the recent theories in solving transportation problem to gain much efficiency. This is because of its ability to solve complex optimization problem efficiently. It is a type of optimization technique that can be applied in many situations and it also has much practical application. A good transportation system is one that establishes the least cost, most efficient transportation connection (network) while honouring all customer's service requirement[1]. To attain such efficiency is always a problem encountered in transportation problems. Solving transportation problem using optimization method involves transporting products from several sources to several destinations in such a way that it minimizes its cost or maximizes its profit which is achieved by finding an optimal route to the destination[2][3]. However, to find an optimal route (finding the shortest route with least cost) has been a major problem in transportation. This type of problem in transportation has been solved through many methods, but the problem becomes more complex when having a large number of delivery and receiving locations. In spite of many researches and methods proposed to solve this problem, having large points to cover (solving optimization problem with a large search space) is always a prevalent issue. This complexity makes the conventional methods of solving this type of transportation problem inefficient. Therefore, a method that is not affected by this complexity is introduced in other to get an optimal solution (finding the best solution from all possible solutions).

Particle swarm optimization resolves this complexity by using computational intelligent techniques (computational intelligent technique is a method used in solving problems that are complex and therefore cannot be effectively solved using normal computational algorithms) which is motivated from simulation of social behaviour of animals(birds and fishes)[4]. It uses a theory that initializes a system with a population of random solutions and searches by updating generations to solve complex problem (by using an input of a very large volume of data). Particle swarm optimization is a swarm intelligent-based(SI) technique that got its inspiration from the social behaviour of some insects and animals (particles). These particles improve themselves by cooperating and sharing information among each other and with this, they are able to learn and improve to provide the high efficiency needed.

In particle swarm optimization, the particles in large population move in search of space in other to find an optimal route to their destination. These particles use the advantage of populated individuals to search through search space and find better position. They communicate among themselves to find one with better condition and the one with better condition in turn relates its information to others. Other particle members will follow the one with better condition (by continually changing their velocity to the velocity of the particle with better condition) until all arrive at the best location[5][6]. Thus this theory of particle swarm optimization is transformed as an algorithm and is used to solve transportation problem in finding an optimal route.

Approach to optimization in transportation has evolved through the years from its traditional search algorithm to recent computational intelligent techniques. In this study, a brief review of some common traditional path-finding algorithm and some path-finding-based problems[7][8] is done. Few computational intelligent techniques with particle swarm optimization inclusive are also briefly explained[9]. A detailed explanation on how particle swarm optimization technique works in route optimization is also treated. The PSO algorithm was also implemented to form a minimal spanning tree and to solve the transportation problem on the travelling salesman problem. Its applications and benefits are also considered within the cause of the study.

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II. Graph Theory

There are so many parts that can exist from a source to a destination node in a graph, but finding the optimal path is always a problem. Vertices-edges graph can be used as mathematical model to help analyze such problems[10]. Vertex-edges graph is used to describe how to find an optimal path, such as the best route (i.e. shortest distance, less cost distance, etc). A route is considered to be optimal when it provides the shortest and the easiest path to a destination as well as the least cost[11][12]. And solution to this optimality could be attributed to finding the objective function of the optimization process and choosing the objective function to be the minimum distance travelled (or the fitness function of the particle when the particle is at its highest velocity in its best position).

A. The Shortest-path Problem Variants

According to graph theory, to solve the problem of shortest path is by finding a path between two vertexes (nodes) such that the weight of its constituent links is minimized[12]. The minimum weight gotten depends on the goal, and this varies depending on the problems that are encountered during shortest path search. Below are some of the variants of the shortest-path problem.

Single-source single destination problem: The single-source single destination problem variant finds the shortest path from a source to a destination[7].

Single-source all destinations problem: This, finds the shortest path from a source to each vertex.

Single-destination shortest path problem: This variant finds the shortest path to a given destination (vertex) from each vertex.

All-pair shortest path problem: The all-part shortest path problem variant finds the shortest path from all sources to all destinations. This means to compute the length of the shortest path between every pair of vertices in a graph[7].

Minimum spanning tree: A minimum spanning tree in an undirected weighted graph is a spanning tree whose connections sum to minimum weight. A minimum spanning tree has basically two properties: (a) it connects every vertex in the graph i.e. it spans the graph. (b) The total weight of all the edges is the least. Therefore, a minimum spanning tree is formed when the sum of all the edges in a spanning tree is the minimum over all spanning trees of a graph[13][12].

Traveling salesman problem (TSP): TSP aims at finding a circle in a complete weighted graph, which goes through all its vertices to find a path with minimal path. In other words, it finds a minimal Hamiltonian circle in a complete weighted graph. The traveling salesman problem based its theory on a salesman and his tour given a set of cities. The salesman tour starts from one city to visit all the cities involved and finally returns to the starting city. A cycle formed in a graph during a tour by pairing all the vertices once is known as a Hamiltonian cycle[14][15].

B. Shortest-path Canonical Algorithm

Some algorithms were earlier proposed to solve the shortest path problem in various applications including transportation problem application. A quick review of few of them are considered below[8].

a. The Dijkstra's algorithm: this algorithm is used to solve the single source shortest path problem with non-negative weights. It finds the shortest path to all other vertices in a graph starting from one vertex.
b. The A search algorithm: this algorithm considers one node and follows its outgoing connections at each iteration. Each chosen node is known as the current node and this current node is chosen using selection search algorithm.
c. The Floyd-warshall algorithm: this is an algorithm for shortest path problem, it finds the shortest path between all pairs of vertices in a directed graph with arbitrary edges weight without the negative weights.
d. The Bellman-ford algorithm: this algorithm is used to find the shortest path from source vertex to all other vertices, and are usually used when there are negative edge weights.

C. Bio-inspired Algorithms

Because standard traditional optimization methods are often not able to solve the problem of increased complexity in large scale of network within an acceptable period of time, new algorithms which are nature-inspired are introduced to solve the limitations of these optimization methods and increase the number of solvable problem. The nature-inspired algorithm receives its sole inspiration from nature. The traditional methods of solving optimization problem requires enormous computational effort, and tends to fail as problem size increases. This is a motivation for nature/bio-inspired stochastic optimization algorithm. This new optimization approach is more computational efficient to deterministic approaches. The nature-inspired methods of optimization are heuristics that imitates the strategy of nature since many biological processes can be thought of as process of constrained optimization.

Particle swarm optimization recently has proven to be one of the highly efficient ways of solving optimization problems. PSO, like the evolutionary algorithm is a population-based algorithm, as well as a swarm-based algorithm. Its general idea, as already stated in the previous section, is from using the combine behavior of birds (or fishes) and human social behaviour (co-operation) to solve optimization problems. Particle swarm optimization is generally about using swarms of particles (birds or fishes) i.e. a potential solution flying through a search space (problem space), to get to an optimal solution to a given problem. Each particle co-operates with other individual particles in the swarm and they exchange information about their fitness, and each individual keeps track of its fitness so far and other particlesfitness. This fitness tracking is what compels these particles to fly towards the current optimum solution[16][9]. Besides the global acceptance of PSO, there are other optimization algorithms which have been used ages before Eberhart and Kennedy proposed the PSO algorithm in 1995[17]. These other algorithms are briefly stated below.

The genetic algorithm: The genetic algorithm (GA) follows the principle of Charles Darwin's theory of survival of the

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fittest. The algorithm begins by initializing a population of solution (chromosome). For each chromosome, a fitness evaluation is done based on an appropriate fitness function suitable for the problem, and based on this fitness evaluation, the best chromosomes are selected into the mating pool where they undergo crossover and mutation thereby producing a new set of solution (offspring)[9][18].

Differential evolution: The differential evolution (DE) theory was proposed by Storn and Price in 1995 [19]. The DE also uses population of individuals to search for an optimal solution, but the mutation in DE is as a result of arithmetic combination of individuals while in GA, the mutation is as a result of perturbations to individual. The mutation operators in DE favour exploitation. The DE automatically adapts the mutation increments to the best value based on the stage of evolutionary process[9].

Ant colony optimization: ACO (ant colony optimization) is a swarm based algorithm introduced by Dorigo and Di Caro in 1999[20]. It is inspired by the collaborative behaviour and movement of ants and their abilities to find the shortest path to their destination as they search for food. They achieve their aim by tracing pheromone trails in such a way that their decision on direction of movement is based on the strength of the pheromone they deposited (the stronger the pheromone trail, the higher the desirability). They form their path by following the path that has high pheromone concentration. The ACO algorithm is formed by using this concept to develop a meta-heuristic approach for solving optimization problems[9].

III. Related Work

The concept of applying PSO to solve complex problems have been researched globally. This section highlights some of the approaches already employed in solving optimization problems.

Baridam [21] worked on comparing the quality of clusters that is generated by each distance measure. According to this paper, the efficiency of PSO-based clustering method in clustering nucleic acid sequence was adjured better from analysis compared with distance measures.

In 2010, Hsiesh et al. [22] worked on applying PSO algorithm to schedule order picking route. The scheduling of order picking route is used to order the performance of an order picking operation in a distribution center. The combination of GA-PSO algorithm was used to find the optimal shortest path and shortest time of the order picking route.

Another work by Mohammed and Sahoo[23] in 2009 was on hybridization of PSO and noising method for solving the single-source shortest path problem (SSP) using graph theory. The proposed algorithm was to use a new encoding and decoding scheme based on heuristics to represent the SPP parameter as particles in PSO, while a noising method-based meta-heuristics (noisy local search) are used in other to improve the overall search efficiency.

Toofani[11] in 2012 solves routing problem using PSO algorithm. The main objective was to minimize the cost path using a graph to represent the network routes. The method was to use an encoding technique which divides the whole search space into smaller spaces and find their shortest path, and later he combined all the solutions to find an optimal path.

Sombunthan and Kachitvichayankul[2] in 2010 used a variant of PSO known as GLNPSO to solve a multi-depot vehicle routing problem with simultaneous pick-up and delivery with time window. The GLNPSO is a version of PSO algorithm with multiple social learning structures where the real-value PSO is used to construct customer's priority list and vehicle priority matrix through encoding and decoding method.

In 2011, the trio of Chan, Mu-yen and Hsieh[24] applied PSO algorithm in finance to support vector machine (SVM) for prediction of financial bankruptcy. They proposed the PSO-SVM for prediction of co-operate financial crisis which will also help investors to make the correct investment.

A research by Sooda and Nair[18] in 2011 was carried out to find an optimal network route. The PSO algorithm was used with the concept of region based network to find an optimal path. They aim to select an optimal node which will help to achieve a higher performance in a network.

PSO algorithm was involved in the regression analysis for prediction of wood pulp demand in 2013 by Anandhi and Manicks[25]. Their aim was to predict an increase in wood pulp demand which could be reduced by increasing the quantity of wood pulp in manufacturing industries. The PSO algorithm was used together with SMV regression analysis method to improve on accuracy of the prediction.

Goldbarg et al.[14] proposed an approach on PSO algorithm to solve traveling salesman problem. The approach considered distinct types of velocity operators, each of them concerning one movement on particles. The proposed algorithm was found to produce high quality solution when compared with other heuristic methods for TSP.

Wang et al.[26] in 2013 proposed a PSO algorithm with mobile operator and mobile sequence for solving TSP problem.

In 2012, Mohamed [12] used PSO algorithm to form a minimal spanning tree in a given network with routes. In his proposed algorithm he introduced a fitness function formula which he uses to achieve his goal.

Givalnado et al.[13] in 2006 proposed a PSO algorithm to solve a multi-criteria degree constrained minimum spanning tree problem. The proposed algorithm uses local search and path-relinking procedure as velocity operators. The result was compared with other evolutionary algorithm and the proposed algorithm show high quality solution for the problem.

IV. PSO Algorithm in Transportation Network

This work is a combination of using discreet mathematics and a branch of computer science known as evolutionary computing to solve transportation problem (i.e. using PSO as an optimization solution to transportation problem). This work demonstrates the efficiency of PSO in transportation problem by using PSO algorithm to find the shortest distance in a given transportation network.

V. The PSO Algorithm and Theory

The concept of behaviour of flocking birds stimulates the basic PSO theory. This behaviour of flocking birds involves

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a swarm of birds that are randomly searching for food and the destination of the food is located at a particular point. These birds fly through a search space to a certain destination in search for food. They transmit information to each other about their flight position, and others will always follow the one which has found a better position that is nearer to their destination. In the same manner, the PSO algorithm follows this concept by populating particles in a search space to their destination by other particles in the swarm following the particle with the highest fitness(known as the current optimum particle). The particle swarm optimization algorithm is an adaptive algorithm which is based on population of individuals that adapt by moving towards previous successful region. The algorithm has its primary operators as Velocity update and Position update. For every generation, particles are accelerated each towards the *Pbest* (particles personal best position) and *Gbest* (the global best position). For each iteration, velocity is updated by calculating a new velocity value for each particle. This new velocity is calculated based on the particles current velocity and distance which are both from the previous best position and the global best position. The value of the new velocity is then used in calculating the next position for the particle in the search space. This process is continued iteratively until a stopping condition is reached[16][27].

Algorithm 1: The Basic PSO Algorithm

Step 1: Initialization:
Initialize the swarm by randomly assigning each particle to an arbitrarily initial velocity and a position in each dimension of the solution space.

Step 2: Fitness value Evaluation:
Evaluate the fitness function which is to be optimized for each change in particles position

Step 3: Update the Pbest (Personal best):
For each particle, update its historically best position so far using fitness value up the fitness value of the particle is better than best fitness value in history, set the correct value as the new Pbest.

Step 4: Update the Gbest (global best):
Update the entire swarms best particle which has the swarms best fitness value. (Choose the fitness value of the particle with the best Pbest value).

Step 5: Velocity update:
Calculate the velocities of all the particles using velocity equation

Step 6: Position update:
Update the particles new position using the position update equation. (This means moving each particle to its new position using the position equation).

Step 7: Stopping criterion:
Repeat step 2-6 until there is convergence or a stopping criterion is met. Stopping criterion includes:

- When the maximum number of allowed criterion is reached
- When a sufficiently good fitness value is achieved
- When the algorithm has no improvement in its performance within a number of consecutive interactions or when there is no significant change in fitness value function [10].

The transportation problem proposed in this paper is solved based on the concept of the multi-modal function landscape. The multi-modal functions have multiple local minima, which means that the search having the function of multiple minimum, graphically, there exist a rough search space with multiple peaks[10]. Applying this concept, particles come from different unknown sources through a search space and move toward any unknown destination. This unknown destination is known as an optimum point or destination point.

Algorithm 2: The Proposed PSO Algorithm for finding the Shortest Path

Step 1: Initialization:
Initialize the particles position using different points on the graph (see next chapter for graph).

Step 2: Get total distance:
Get the total distance as of each path (particle) at the initialization stage

Step 3: Set the target value (a targeted minimum distance).

Step 4: Set the iteration number to zero. While the maximum number of iteration is not reached or target value not achieved,

- get Cartesian distance by using the Cartesian equation to calculate the distance between two points, and also calculate the total distance of each particle.
- get the *Pbest* and *Gbest* from the distances calculated, get the particles personal best i.e. the shortest path (a path = a particle, see encoding in next section). The first *Pbest* values are the initial calculated path of the particles. And also get global best position (*Gbest*) which is the shortest path among all the initiated paths.
- if *Pbest* equals target value, terminate iteration (here the *Pbest* is used as the fitness function).
- sort the particles by their *Pbest* scores from best to worst, to get the worst *Pbest* as $Pbest_w$
- get velocity; by calculating the velocity of each particle using the velocity equation. The velocity equation used is
$velocity = Vmax * Pbest_i/Pbest_w$
- update particles position; here the particles position is updated based on its velocity.
- increment iteration.

Step 5: Stop the algorithm using the stopping criterion given. The algorithm uses the target value as its stopping criterion.

The proposed algorithm uses single sighted topology to move particles towards global best by copying the next best particle. This topology method also helps to monitor (calculate) the position of each particle which makes it easy not to lose any information, and also speeds up the whole process. The algorithm also uses the global worst parameter in terms of personal best worst ($Pbest_w$) together with personal best (*Pbest*) to calculate the velocities of the particles. The idea of

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combing the worst *Pbest* and *Pbest* is to alter the content of the worst Pbest and replace some of its elements by its opposition values (this idea is inspired by the concept of opposition-based learning). After the altering, the worst *Pbest* will behave in such a way that it will move out of its regular path (cognitive avoidance) and then affects other particlesbehaviour[27][4]. Cognitive avoidance is when particles avoid itself from moving towards its known worst position or personal worst position. This helps the particles to move to proper direction by avoiding probable mishaps. The concept of opposition-based learning considering the proposed method is on the basis that sometimes the current solution to a problem is farther away from the optimum than its opposite solution and by considering both, we may improve our chances of finding the optimum faster.

VI. PSO Algorithm and the Transportation Problem

The exact approach in this paper is to use PSO algorithm as a population based algorithm to find the shortest distance from all possible routes in a network (i.e solving the shortest path problem). Shortest path problem in transportation system could be in form of individual trip planning, vehicle routing, goods movement, etc. Among various ways of solving shortest path problem includes forming a minimal spanning tree giving a graphical representation of routes in a network, and also solving a travelling salesman problem within a given network area. Each of these ways gives the shortest path to a destination in a network of multiple routes.

This work solves a transportation problem in a given network of several routes. It uses PSO algorithm to find the minimum distance in the network forming a minimal spanning tree (MST), and also it uses PSO algorithm to find the minimum distance in the same network, solving a travelling salesman problem (TSP). The result of PSO on MST is compared with the result of PSO on TSP.

MST is a spanning tree formed when all connections in a spanning tree is the minimum over all spanning trees of a graph. A spanning tree is formed from a graph when all the nodes in the graph are connected (i.e. each node is visited once) and the connection does not form a cycle[13]. TSP, on the other hand, is a path problem that finds the shortest path where all the nodes in the graph are connected to each other, forming a cycle (with TSP, the nodes are all visited once except the source node which is visited twice)[15].

The PSO is implemented by applying PSO algorithm to solve the transportation problem of movements from different sources toward any destination, whose optimal route is found to be the shortest distance considering all other possible routes in the network. Finding the shortest path means finding the shortest distance of any path considering all the possible paths in the network. This is done by calculating the distance of all the possible paths formed in the network and the shortest calculated distance is considered to be the shortest path. A graph is used to represent a network of routes with points (cities) connected to each other.

Problem formulation: PSO as a swarm-intelligent-based technique is used to solve routing problem which gives optimal path from a graph. The objective is to minimize the distance traveled from a source to a destination (i.e. to find the shortest distance considering all the possible routes involved). Therefore, the objective function finds the minimum distance from the source to their destination by following the best path found during their search. This best part is found when a particle finds its *Pbest* and *Gbest*. The *Pbest* and *Gbest* are found by calculating the fitness function of the particle any step in time. Lets consider a transportation case where someone is on a business trip, having an area to cover. And this area has several points which he must visit during his trip to make a complete tour. These points must be visited once during each tour. He wants to find a network that connects all the points with a minimum distance. In other to find the path with the shortest distance, he has to consider the recorded distance for every route. The shortest distance found will give him a faster and more efficient tour.

The PSO algorithm is employed to find the shortest distance in this transportation case as follows:
(a). Using PSO algorithm to form a minimal spanning tree in a graph. Here the traveler travels from one point (source point) to another (destination point) and visits all the points (cities) once during his tour to form a path, and this path has the minimum distance considering all other paths available within the area to cover.
(b). Using PSO algorithm to solve a travelling salesman problem on a graph. The traveler visits all the points (cities) once but the source point (city) is visited twice during his tour thereby forming a cycle by the end of his tour. This cycle form the path with the minimum distance considering every other available path within the given area.

Given V = $(V_1, V_2, V_3, ..., V_n)$ set of vertices or routes linking different points(cities), and X = $(X_1, X_2, X_3, ..., X_n)$ set of positions of the points (cities), the algorithm works out the shortest path of all the points (cities) without visiting the same city twice. The proposed algorithm works out the minimum Cartesian distance through the number of points given. If n numbers of points are given, and in connecting these points, it could be said that there are $n!$ number of ways to connect the points to each other (i.e. n x n x n x n x n x n x n x n x n combinations). We are to find the shortest combination on path from a source to a destination considering all the possible paths in the network. Using PSO algorithm on this, we code the path as particles and these particles travel through different routes on the network from one source to a destination and as they move, they communicate with each other about the movement history thereby adjusting their movement to follow the particle with the best movement history in other to get the route with the shortest distance. For this network, there is no set source or destination (i.e. the source could be from any point and the destination could also be at any point). And the path could either travel forward or backward (i.e. the path could take any direction). For instance, path 3-4-5-6-7-0-1-2 is a valid path as well as path 7-6-5-4-3-2-1-0.

Encoding: PSO is a discrete mathematical algorithm used to encode particles to solve discrete optimization problems.

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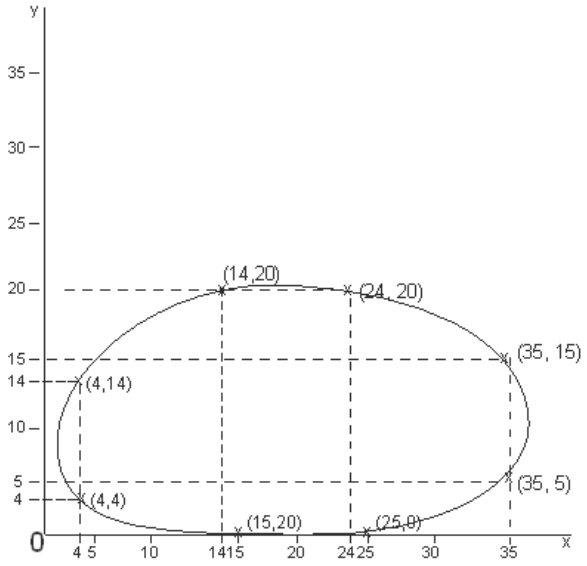

Fig. 1. The Cartesian representation of the points

Considering a network of routes with 8 points with the points connected to each other in all manner of combination (i.e. 8! ways of combination - which means thousands of connections) using eight digit strings 0 to 7(points 0 to 7). The routes involved in this network are all explored in order to find the shortest distance that does not form a cycle. Assuming these points to be 0, 1, 2, 3, 4, 5, 6, 7 i.e. 8 points and their locations on a graph to be X = (25,0); (35,5); (35,15); (24,20); (14,20); (4,14); (4,4); (15,0). Representing these points on a Cartesian graph (with x,y coordinates - figure 1) we choose some paths from any source to a destination and encode them as particles e.g. 10 paths as 10 particles, for example, for shortest path as a minimal spanning tree

```
Path 1 = 2,7,3,4,6,5,0,1 = particle 1
Path 2 = 7,0,1,2,3,4,5,6 = particle 2, etc.
```

Note: The path could start and end in number and the path could go in any direction.

VII. Implementation

We will first workout the preamble for the main algorithm by choosing randomly few paths from the network and get the minimum distance among the chosen paths. This minimum distance gotten will be used as our target value for the algorithm. The target value will be used to check our fitness function evaluation (i.e. by comparing the target value with the distance calculated) Using the Cartesian distance equation,

$$D = \sqrt{(ax - bx)^2 (ay - by)^2} \quad (1)$$

we calculate the distance between two points, and further calculate the total distance of each path. It was found that the shortest distance considering the randomly chosen paths is 76.83 for MST and 86.83 for TSP. Therefore on running the algorithm for the entire network, we target the maximum distance not to exceed 76.83 and 86.83 for MST and TSP, respectively.

FOR MST: The proposed PSO algorithm is to find the shortest path and form a minimum spanning tree from the graph presented above, the search start at any point and go through all possible routes in the entire network visiting each point once.

The variables for the algorithm is Number of particles = 10 (10 paths) City count = 8 Vmax = 4 Target value = 76.83 Iteration number = 1000

```
Result:
Route: 6, 5, 4, 3, 1, 2, 0, 7,
 Distance: 88.29073540474883     - path A
Route: 5, 4, 3, 2, 1, 0, 7, 6, Distance: 76.62998956150375     - path B
Route: 5, 1, 2, 6, 3, 0, 7, 4, Distance: 150.83625892866797    - path C
Route: 0, 7, 4, 1, 2, 6, 5, 3, Distance: 129.6063416202468     - Path D
Route: 5, 3, 0, 1, 4, 2, 6, 7, Distance: 144.0784145633883     - path E
Route: 6, 5, 3, 0, 1, 4, 2, 7, Distance: 134.47994624587162    - path F
Route: 7, 0, 1, 6, 5, 3, 4, 2, Distance: 114.66411088878459    - path G
Route: 4, 6, 0, 7, 1, 2, 5, 3, Distance: 132.7577865749962     - path H
Route: 4, 0, 7, 2, 5, 3, 1, 6, Distance: 159.33936235366934    - path I
Route: 0, 3, 1, 6, 2, 5, 4, 7, Distance: 165.2389659003108     - path J
Epoch number: 78
Target reached.
Shortest Route: 5, 4, 3, 2, 1, 0, 7, 6, Distance: 76.62998956150375
```

Here the points (cities) count is done seven times because the count start from one point and ends at another point going through the whole ten points once. The shortest path on this approach is found to be 5-4-3-2-1-0-7-6 with distance of 76.63. The shortest path has its source at point 5 and its destination at point 6.

FOR TSP: The proposed algorithm is also used to solve the travelling salesman problem from the same graph thereby forming a cycle as its shortest distance. It uses the same proposed using the algorithm and variables as with MST but with different values,

The variables for the algorithm is Number of particles = 10 (10 paths) City count = 8 Vmax = 4 Target value = 86.83 Iteration number = 1000

```
Result:
Route: 7, 6, 5, 4, 3, 2, 0, 1, Distance: 105.273274066912      - path A
Route: 7, 6, 5, 4, 3, 2, 1, 0, Distance: 86.62998956150375     - path B
Route: 2, 3, 1, 0, 5, 4, 7, 6, Distance: 143.38867652878778    - path C
Route: 3, 0, 5, 1, 4, 6, 7, 2, Distance: 171.00655205544194    - path D
Route: 5, 2, 1, 4, 0, 3, 6, 7, Distance: 164.79520013041284    - path E
Route: 6, 5, 2, 1, 0, 4, 7, 3, Distance: 152.59108269076074    - path F
Route: 3, 1, 0, 4, 2, 7, 6, 5, Distance: 141.7791856197275     - path G
Route: 5, 2, 7, 4, 3, 1, 6, 0, Distance: 182.27472656400224    - path H
Route: 0, 6, 5, 2, 4, 7, 3, 1, Distance: 155.71882802909582    - path I
Route: 5, 2, 7, 0, 4, 6, 3, 1, Distance: 184.20310849428913    - path J
Epoch number: 38
Target reached.
Shortest Route: 7, 6, 5, 4, 3, 2, 1, 0, Distance: 86.62998956150375
```

The shortest path on the traveling salesman problem was found by starting from a point (city) and go through all possible routes in the entire network, visiting each point (city) once and return to the starting point (city), thereby forming a Hamiltonian cycle. For TSP, the point (city) counts eight times. Therefore the shortest path on TSP is 7-6-5-4-3-2-1-0 with distance of 86.63. Here the shortest path starts at point 7 as its source and ends at point 0 as its destination. The termination point '0' is expected to be the source on the graph based on the theory governing the TSP.

From the results obtained above, the MST has its shortest route to be with distance of 76.83, the TSP has its shortest route to be with the distance of 86.3. This is because MST

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forms a spanning tree as the minimum calculated distance. The spanning tree is formed by connecting every point in the network and this point is visited once. While on the other hand, the TSP forms a circle on its shortest path which is the shortest calculated distance found within the network. The connection is done to every node in the network such that the connection forms a circle within the network. The circle is formed by connecting the last visited node with the source node. This extra connection added an extra distance to the previously shortest distance found. And this is the reason for the difference in results of MST and TSP.

VIII. Conclusion and Further Research

In this paper, PSO algorithm is used to solve a transportation problem of finding the shortest path to form a minimal spanning tree (MST) and to solve the travelling salesman problem (TSP). The proposed algorithm is used to optimize the objective by finding the minimum distance in a network. The PSO algorithm is used to get a minimum path among various paths in a transportation network. PSO algorithm is very efficient in solving many optimization problems which also includes optimization in transportation system. The PSO algorithm runs efficiently in a transportation system which has many complex routes. It gives the shortest path among many paths in a given network within a small amount of time. From results obtained, the PSO algorithm has shown to be effective on solving transportation routing problem by forming an MST as the shortest path in a given network of routes and the algorithm is also used to solve the travelling salesman problem as shortest path in the same network of routes.

The MST and TSP are both useful in determining the shortest path in transportation system. The choice of which depends on the reason for the tour. When the reason is basically for a trip tour from a source to a destination, the MST is recommended to be applied. MST has the benefit of cutting down on extra distance since it does not visit a point twice. While the TSP is highly considered when the tour comes back to the city where it started.

The method used in the proposed method manages the advantages of exploitation and exploration to enhance the optimization of the algorithm. The algorithm is found easy because particle encoding is easy and the variables which are used are not much, thereby making use of less memory and less cost. The algorithm was able to find the shortest distance within few iterations. This work will stand as a basis for further various objective optimizations in transportation network. In particular, the method will be extended to solving the traffic problem in a high traffic industrialized city.

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A survey of Cloud Computing Security challenges and solutions

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Abstract

Cloud computing is the next generation networks which is soon going to revolutionize the computing world. It has much flexibility like on demand resources and services availability. Security is still critical challenge in the cloud computing paradigm. These challenges include user's secret data loss, data leakage and disclosing of the personal data privacy. In this paper a comprehensive survey of existing literature for cloud computing security challenges and solutions is presented. At the end of this paper the authors propose a model for cloud computing security.

Key words: Cloud computing, cloud computing security, IaaS, PaaS, SaaS

1-Introduction

Cloud Computing has recently emerged as new paradigm for hosting and delivering services over the Internet. The cloud computing is an internet based environment allows us to use software, data and services over the internet from any location on any web enabled device [3]. The researchers in the studies [8, 10, 9], define cloud computing as ''a style of computing where massively scalable IT-enabled capabilities are delivered 'as a service' to external customers using Internet technologies. Cloud Computing is considered as the first among the top 10 most important technologies and with a better prospect in successive years by companies and organizations [2]. In [4] researchers estimated that 12% of software market will move toward cloud computing from 2011 to 2016 and the amount growth of cloud computing market will reach $95 billion. The cloud computing provides different services, these services put forwarded three layers Infrastructure models which are infrastructure as Services (IaaS), Platform as Services (PaaS) and Software as Services (SaaS) [5, 11].

IaaS Cloud computing providers offer physical, virtual computers and extra storage networking devices [13]. Example of IaaS vendor services includes Amazon Elastic Compute Cloud (EC2), GoGrid and Rackspace Cloud.

(PaaS) involves providing Infrastructure as a Service plus operating systems and server applications such as web servers [22]. Example of PaaS vendor services includes Google App Engine, Force.com, Amazon Web Services Elastic Beanstalk, and the Microsoft Windows Azure platform.

SaaS provides an application to customers either as a service on demand [12]. Example SaaS vendor services include Salesforce.com Customer Relationship Management (CRM), Google Docs and Google Gmail.

Security and privacy are considered as a critical issue in a cloud computing environment due to the sensitive and important information stored in the cloud for customers [6, 7]. Critics argue that cloud computing is not secure enough because data leaves companies' local area networks.

This paper presents a survey of the security of Cloud Computing focusing on the security challenges and solutions for the cloud computing layers models.

The rest of this paper is organized as follows: Section II introduces Infrastructure as Service security challenges. Section III describes the security challenges for Platform as Services. In section IV the security challenges for Software as Services is introduced. Section V presents a proposal model for cloud computing security. Section VI concludes the paper.

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II- Infrastructure as Services (IaaS) security challenges

Cloud Service Provider (CSP) outsources storage, servers, hardware, networking components, etc. to the consumer in IaaS model. CSP owns the equipment and responsible for housing, running and maintaining it. In this model, consumer pays on per-use basis. Characteristics and components of IaaS include [14]:

- Service Level Agreement (SLA)
- Dynamic scaling
- Automation of administrative tasks
- Utility computing service and billing model
- Internet connective
- Desktop virtualization

The virtualization risks and vulnerabilities that affect particularly IaaS delivery model are:

1- Security threats sourced from host

a- Monitoring VMs from host

The control point in virtual environment is the host machine there are implications that allow the host to monitor and communicate with VM applications up running. Therefore, it is more necessary to strictly protect the host machines than protecting distinctive VMs [25]. VM-level protection is crucial in cloud computing environment. The enterprise can co-locate applications with different trust levels on the same host and can defend VMs in a shared multi-tenant environment. This enables enterprises to maximize the benefits of virtualization. VM-level protection allows VMs to stay secure in today's dynamic data centers. Also, as VMs travel between different environments – from on-premise virtual servers to private clouds to public clouds, and even between cloud vendors. [15]

b- Communications between VMs and host

The data transfer between VMs and the host flow between VMs shared virtual resources; in fact the host can monitor the network traffic of its own hosted VMs. This can be considering useful features for attackers and they may use it such as shared clipboard which allows data to transfer between VMs and the host using cooperating malicious program in VMS [17].

It is not generally considered a bug or limitation when one can initiate monitoring, change, or communication with a VM application from the host. The host environment needs to be more strictly secured than the individual VMs.

The host can influence the VMs in the following ways[16]:

- The host can Start, shutdown, pause, and restart VMs.
- Monitoring and configuration of resources which are available to the VMs, these include: CPU, memory, disk, and network usage of VMs.
- Adjust the number of CPUs, the amount of memory, the amount and number of virtual disks, and a number of virtual network interfaces which are available to a VM.
- Monitoring the applications which are running inside the VM.
- View, copy, and possibly modify, data stored on the VM's virtual disks.

Unfortunately, the system admin or any authorized user who has privileged control over the backend can misuse these procedures. [17]

2- Security threats sourced from other VM

a- Monitoring VMs from other VM

Monitoring VMs could violate security and privacy, but the new architecture of CPUs, integrated with a memory protection feature, could prevent security and privacy violation. A major reason for adopting virtualization is to isolate security tools from an untrusted VM by moving them to a separate trusted secure VM [14, 15].

b- Communication between VMs

One of the most critical threads that threaten exchanging information between virtual machines is how it's deployed. Sharing resources between VMs may strip security of each VM for instance collaboration using application such as shared clipboard that allow exchanging data between VMs and the host assisting malicious program in VMs, this situation violate security and privacy. Also, a malicious VM can has chance to access other VMs through shard memory [16].

c- Denial of Service (DoS):

A DoS attack is a trying to denial services that provide to authorize users for example when trying to access site we see that due to overloading of the server with the requests to access the site, we are unable to access the site and observe an error. This happens when the number of requests that can be handled by a server exceeds its capacity, the Dos attack marking carting part of clouds inaccessible to the users [26]. Usage of an Intrusion Detection System (IDS) one of the useful method of defense against this type of attacks [27].

3- Networks & Internet Connectivity attacks

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Practical solutions and techniques for eliminating these attacks or reducing their impacts are listed as follows:

1- Logical network segmentation
2- Firewalls implementing
3- Traffic encryption
4- Network monitoring

III- Platform as Services (PaaS) security challenges

PaaS is a way to rent hardware over the Internet, PaaS provide capability to manage application without installing any platform or tools on their local machines, PaaS refers to providing platform layer resources this layer including operating system support and software development frameworks in which it can used to build higher – level services. [23], developer gets many advantages from PaaS these are:

- OS operating system can be changed and upgraded as many time as need.
- PaaS allow geographically distributed teams to sharing information to develop software projects [14].

The use of virtual machines act as a motivated in the PaaS layer in Cloud computing. Virtual machines have to be protected against malicious attacks such as cloud malware. Therefore maintaining the integrity of applications and well enforcing accurate authentication checks during the transfer of data across the entire networking channels is fundamental[18]

PaaS security threat can be summarize as:

a- Data location

The actual platform is not in a single host, the platform can be thought as group of cluster hosts, in fact the location of your data cannot be isolated to specific sector on specific host, this will add more security over head as far as a single location is easier to secure than many.

Another security issue is that the duplication of data creates high availability of data for developers and users this distributed data remains like other data the big difference in this case in the exact location is unknown [24].

b- Privileged access

One of the most popular features in PaaS is the advertised software developers to use debug. Debug grants access to data and memory locations in order to allow the developers to modify values to test various outcomes we consider the debug provide the desired tool for both developers and hackers. [20]

c- Distributed systems

The PaaS file system is often highly distributed. The nodes can be independent while cloud service provider (CSP) owns the cluster so most likely to standardized configuration paths will be in place. The CSP should be able to provide the necessary security, but the responsibility for verifying this belongs to the client [1].

Practical solutions and techniques for eliminating these attacks or reducing their impacts are listed as follows:

- Encapsulation Encapsulating access control policies with objects can be one of the solutions to resolve Privileged access
- Policy enforcement points (PEPs) A Policy Enforcement Point (PEP) is the logical entity or place on a server that makes admission control and policy decisions in response to a request from a user wanting to access a resource on a computer or network server. And this consider solution for distributed system [20]
- Trusted Computing Base (TCB) is a collection of executable code and configuration files that is assumed to be secure. TCB is thoroughly analyzed for security flaws and installed as a layer over the operating system and provides a standardized application programming interface (API) for the user objects, encryption seems to be the best possible solution.[21]

IV- Software as Services (SaaS) security Challenges

SaaS also called "software on demand" using SaaS provider licenses an application to customers either on demand through a subscription or at no charge and this consider part of utility computing model, where all technology in the cloud accessed over internet as service. SaaS was basically widely deployed for sales force automation and Customer Relationship Management (CRM). Now, it has become common place for many business tasks, including computerized billing, invoicing, human resource management, financials, document management, service desk management and collaboration [14]. Software as a service applications are accessed using web browsers over the Internet. Therefore, web browser security is vitally important. Information security officers will need to consider various methods of securing SaaS applications. Web Services (WS) security, Extendable Markup Language (XML) encryption, Secure Socket Layer (SSL) and available options which are used in enforcing data protection transmitted over the Internet [18]

The service provider has to verify that their multiple users do not violates privacy of the other users, also it is very essential for user to verify that the right security measures are in place mean while it is difficult to get an assurance that the application will be available when needed [19].

SaaS security threat can be summarize as

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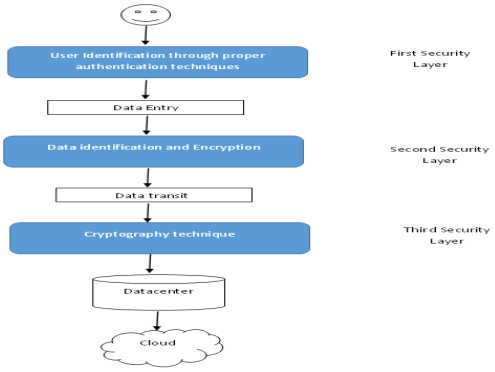
- Authentication and authorization
- Data confidentiality
- Availability
- Information security
- Data access
- Data breaches
- Identity management and sign on process

Navneet Singh [19] suggested practical solutions to assess the security threats in SaaS in which the customer must be asked:

- What metrics can be used for reporting?
- What is the level of access controls?
- Is the provided data can be easily adapted in the internal monitoring tools?
- How important and critical the enterprise data is?

V- proposed model

The proposed cloud security model is compose of three layers. In the first layer user's identification can be checked through proper authentication techniques. Security in the second layer depends on data identification and encryption. At the last layer cryptography technique is used to secure the transmission of the data. The architecture of the proposed model has been shown in figure (1)



VI-Conclusion

This paper gives a survey of different threats and solutions in cloud computing environment with respect to security and privacy of user's sensitive data in the cloud environment. The paper focusing on the security challenges and solutions for the cloud computing layers models. Authors have proposed model for cloud computing security.

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Clustering of graphs using Divisive Hierarchical Approach

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***Abstract*—Graphs are mathematical models of network structures. Graphs are used in an effective manner to represent high dimensional data. Due to increased high dimensional nature of data, we proposed an efficient algorithm to find similarity between the graphs and we show that our approach reduces the search space by effectively pruning the graph data. We also proposed an efficient clustering algorithm for clustering of graphs that uses divisive hierarchical approach.**

Keywords-component; Graphs, Edit distance, Graph clustering, Divisive hierarchical.

I. INTRODUCTION

Graphs are mathematical structures used in representing different types of data. They can represent the data where one element establishes a relationship with the other. There are many domains where graphs are used. A graph can be used to represent social networks, transportation networks, telecommunication networks, information networks etc. A graph is constructed using a set of nodes and a set of edges. Each data element is represented by a node and a physical or logical relation between the data elements is represented by an edge.

Clustering is a technique of grouping similar objects and separating dissimilar ones. There are many graph-based clustering algorithms [6, 7, 18]. Given a set of data points, these algorithms construct a graph on those data points and apply a graph clustering algorithm to cluster the given data. Graph-based clustering is entirely different from graph clustering. Graph clustering [8] is to find similar vertices from a given graph and form clusters. This technique of finding similar vertices in a single graph should not be confused with clustering of several graphs.

There are two types of clustering algorithms for graph data. The first type is node clustering algorithms which determine dense regions in a single graph. The second type is structural clustering algorithms which cluster different graphs depending on the structural behavior. Clustering of graphs helps to find the useful knowledge from a graph database. The rest of the paper is organized as follows. Section II describes the related work. Section III presents problem definition and section IV describes Graph distance algorithm and clustering algorithm . Algorithm. Experimental results are discussed in section V and our work is concluded in section VI.

II. RELATED WORK

Clustering of graphs is an initial step to partition the objects from the graph database. According to literature, there are three approaches for clustering of graphs. The first approach is to calculate the edit distances [2,4,10,14,15,20] for grouping of similar graphs. The second approach is computing median graph [1,3,13,19]for a set of graphs. Third approach is based on subgraph mining[11,17].

The distance between two nonhierarchical attributed relational graphs was introduced in [2]. The problem of calculating the distance between two graphs using edit costs was solved in [2]. The edit cost is the sum of edge additions and edge deletions to transform G to G'. The distance measure is defined as the summation of two quantities, one is node recognition cost and the other is a number of transformations needed to transform an input graph into a reference graph. The authors in [2] characterized the graphs using descriptive graph grammars. This procedure of calculating edit distance between two graphs is computationally expensive, especially between two large graphs.

A quadratic programming approach was introduced in [14], the idea is to find fuzzy edit paths between the graphs. The adjacency matrix representation of a graph is converted to a string and string matching techniques are proposed in [4]. A new distance measure was introduced in [10], it is not based on edit costs, it is based on the maximal common subgraph. A graph G is said to be a maximal common subgraph of G1 and G2 if there are no other subgraphs that have more number of nodes than G. However this is not a distance measure rather it is a metric.

In [1], a median graph is computed for graph clustering. A median graph algorithm is combined with graph matching and k-means technique for developing graph clustering system. The concept of the median was extended to graph domain in [19], the authors introduced the concept of median graphs. A median graph is defined as the representative for a set of graphs. A graph clustering algorithm is proposed in [11], it selects informative patterns from the given database and

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weighted sub-structure mining graph technique is used for clustering. The Frequency distribution of connected subgraphs known as fragments are considered in [17] for graph clustering. All the algorithms in the literature are approximate matching algorithms. In our paper, we present a new heuristic graph distance algorithm that optimizes the matching process and reduces the search space of graphs.

III. PROBLEM DEFINITION

A. DEFINITION 1

A graph is defined as a 4 tuple G=(V,E,L,F), where V denotes a set of vertices, E denotes a set of edges, L denotes a set of labels and F is a labeling function that assigns labels to the vertices and edges.

B. DEFINITION 2

Graph edit distance between two graphs G1 and G2 is defined as the minimum number of graph edit operations to transform one graph to another. Graph edit operations include vertex insertion, vertex deletion, edge insertion, edge deletion, vertex label substitution and edge label substitution.

$$EditDist(G1,G2) = c+N_t, \quad (1)$$

Where 'c' is the cost of recognition of nodes, N_t is the number of transformations required to transform G1 to G2.

C. DEFINITION 3

Graph degree distance between two graphs G1 and G2 is defined as the sum of difference between the degrees of corresponding matched vertices u and v plus total number of unmatched vertices in both the graphs, where u represents a vertex from G1 and v represents a vertex from G2.

$$Dist(G1,G2)= \begin{cases} n1+n2-m, \text{ if } m<n/2 \\ \Sigma\,(\,|\deg(u)-\deg(v)|\,)+U, \text{ otherwise} \end{cases} \quad (2)$$

Where n1 is the number of vertices in G1, n2 is the number of vertices in G2, n is max (n1,n2), m is the total number of vertices matched between G1 and G2, U is the total number of unmatched vertices in both G1 and G2. A heuristic is used in defining the distance. If the number of matching vertices is, at least, half of the maximum number of vertices in G1 and G2 then degrees of matched vertices are calculated, otherwise ,distance is given by the difference between a total number of vertices in G1, G2 and number of matched vertices.

Example 1

Consider the graph database shown in figure 1

Distance between the graphs (1) and (2) is calculated as follows:

A number of vertices in Graph (1) and Graph (2) are n1=n2=4.

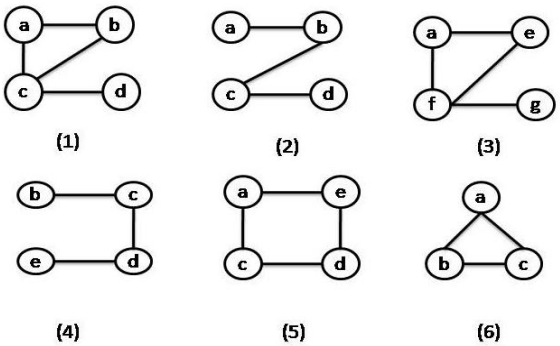

Figure 1. Graph database

	G1	G2	G3	G4	G5	G6
G1	0	2	7	5	4	2
G2	2	0	7	4	4	3
G3	7	7	0	7	4	6
G4	5	4	7	0	3	4
G5	4	4	4	3	0	3
G6	2	3	6	4	3	0

Figure 2. Graph Distance matrix

A number of matched vertices, m=4
n=max(n1,n2)=4
Number of matched vertices m is greater than n/2, the distance between Graph(1) and Graph(2) is
$\Sigma(\,|\deg(a_1)-\deg(a_2)|+|\deg(b_1)-\deg(b_2)|+|\deg(c_1)+\deg(c_2)|+|\deg(d_1)+\deg(d_2)|\,)+0$

$= \Sigma(\,|2-1|+|2-2|+|3-2|+|1-1|\,)+0$
$=2$
a_1 represents the node 'a' of graph(1), a_2 represents the node 'a' of graph(2), similarly b_1,b_2 represents nodes of graph(1) , graph(2) and so on.

Distance between the graphs (1) and (3) is calculated as follows
Number of vertices in Graph (1), n1=4
Number of vertices in Graph (3), n2=4
Number of matched vertices, m=1
n=max(n1,n2)=4
Number of matched vertices m is less than n/2, the distance between Graph(1) and Graph(3) is
n1+n2-m=4+4-1=7

Similarly, the distances between all the graphs are calculated and the distance matrix is shown in figure 2.The distance matrix is a symmetric matrix and it satisfies the following properties.

- $Dist(G_i,G_j)=0$, if i=j
- $Dist(G_i,G_j)=Dist(G_j,G_i)$, otherwise

D. DEFINITION 4

Graph clustering is the process of grouping similar vertices in the given large graph.

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E. DEFINITION 5

Divisive hierarchical clustering is the process of dividing the cluster into smaller clusters until some criteria are met.

F. DEFINITION 6

Given a graph database $D=\{G_1,G_2,G_3,\ldots..G_i\}$, clustering of graphs is to find a set of clusters $\{C_1,C_2,C_3,\ldots.C_n\}$, where each cluster contains similar graphs.

IV. ALGORITHMS

In this section, we describe GraphDistance algorithm to calculate the distance between two graphs and a clustering algorithm to generate clusters of graphs.

A. GRAPH DISTANCE ALGORITHM

Given two input graphs, this algorithm finds the distance between them. We used a heuristic approach to reduce the distance calculation time and we tested the algorithm on a synthetic database.

Algorithm 1. GraphDistance(G_i,G_j)

Input: Given two input graphs G_i, G_j
Output: dist(G_i,G_j), the distance between G_i and G_j.

1. Calculate the number of vertices matched in G_i,G_j and let it be m.

2. if m< n/2 where n=$|G_i|$ if $|G_i|>|G_j|$ or n=$|G_j|$ if $|G_i|<|G_j|$, then distance between G_i and G_j is dist(G_i,G_j)=n1+n2-m.

3. if m≥n/2, distance between G_i,G_j is given by dist(G_i,G_j)= $\Sigma(|\deg(u)-\deg(v)|)$ + U for all the matched vertices u,v, where u Є G_i, vЄG_j .

- In step1 of algorithm1, a number of vertex labels matched in G_i and G_j are calculated.
- In step2, if at least half of the vertex labels are not matched then distance is the difference between the summation of a number of nodes in both the graphs and number of matched nodes. This is the heuristic applied in our algorithm to reduce the distance calculation time.
- In step3, if more than half of the labels are matched then distance is calculated based on the degrees of the graphs.

B. ALGORITHM TO CLUSTER THE GRAPHS

Given an input graph database D, and a number of centers k as input, ClusterGraphs algorithm generate set of clusters. Many clustering algorithms require the number of clusters as input, but in our algorithm, we automatically determine the number of clusters by giving a number of centers as input. In our experiments, we prove that our algorithm is not sensitive to number of centers.

TABLE1. MEMBERS OF DHCA PROCEDURE

Member	Explanation
cen	**An array that holds k random centers**
rem	**An array that holds indices of remaining graphs**
$clust_i$	**An array that stores nearest neighbor of graph i**
$dist_i$	**An array that stores distance between graph i and all the remaining gaphs.**
m	**Variable that stores graph index which is a center in each step.**
l	**Variable that stores graph index other than the center in each step.**
mindist	**Shortest distance between l and all the random centers in m.**
minl	**A graph index that is closest to graph l.**
c	**An array that stores number of graphs in each cluster**

Algorithm 2. ClusterGraphs(D,k)

Input: Graph database D, Number of centers k.
Output: Cluster set Clust=$\{C_1,C_2,C_3,\ldots..C_n\}$, where $C_1,C_2\ldots$ represents clusters.

1. Scan the graph database D and calculate the distance between the graphs using Graph Distance Algorithm.

2. Apply DHC (Divisive Hierarchical Clustering)procedure for grouping the related graphs into clusters $Clust_i$ based on the distance vector dist.

3. Repeat step2 if the number of graphs in a cluster $Clust_i>k+2$, where k is the number of centers given as input to divisive hierarchical clustering Algorithm.

- In step1 of Algorithm2, graph distance matrix is calculated by repeated invocation of GraphDistance algorithm as shown in figure 2.
- In step2, call DHC procedure to find cluster set $Clust_i$
- If the number of graphs in a cluster is greater than k+2 then repeat step2. This step automatically determines the number of clusters.

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C. DHC PROCEDURE

Given distance matrix and number of centers as input, DHC procedure group the related graphs into clusters.

Input: Graph Distances $dist_{ij}$, number of centers k.
Output: Cluster $Clust_i$.
1: Select k number of graphs as random centers.
2: Assign each graph to its closest center to create k partitions in the database.
3: for each k partition, DHC recursively selects k random centers and continues the clustering process within each partition until a termination condition is met.

- In step1 of the procedure, select k number of graphs as random centers.
- In step2, assign each graph to its closest center and this creates k initial clusters.
- For every cluster apply the DHC procedure recursively and terminate the recursion if the number of graphs in a cluster is not more than k+2.

The implementation details of DHC procedure is given in the pseudo code.

1) Pseudo code for DHC procedure

Begin
1. Select *k* random centers.
2. Assign *k* centers to *cen* and all the remaining graph indices to *rem.*
3. For each graph *l* in *rem*
{
Find nearest center *minl* out of *cen*.
m=cen[j];
if(mindist≥dist[*l*][*m*])
{
mindist=dist[*l*][*m*];
minl=*m*;
}
4. count the number of graphs in every cluster
c[*minl*]=c[*minl*]+1;
clust[*minl*][c[*minl*]]=*l*;
}
End

V. RESULTS

We implemented our clustering algorithm and tested on synthetic dataset produced by a graph database generator [16]. It is based on the IBM Quest Synthetic Data Generation Code for Association and sequential patterns. The data sets are generated based on the four parameters. D be the total number of graphs in the database, V be the number of vertex labels and E be the number of edge labels, T is the average size of each graph based on the number of edges and M be the

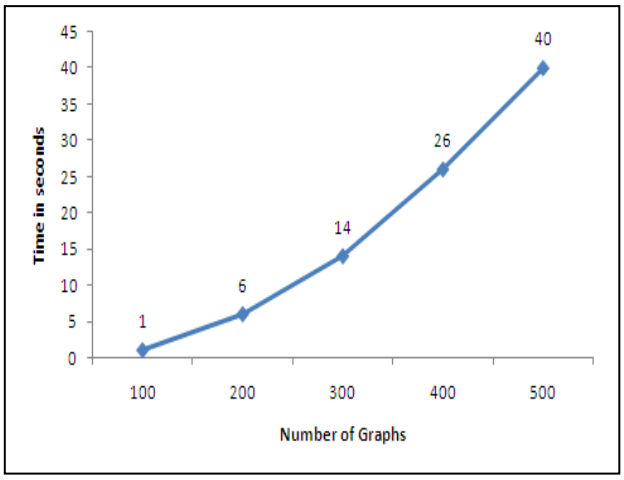

Figure 3. Running time

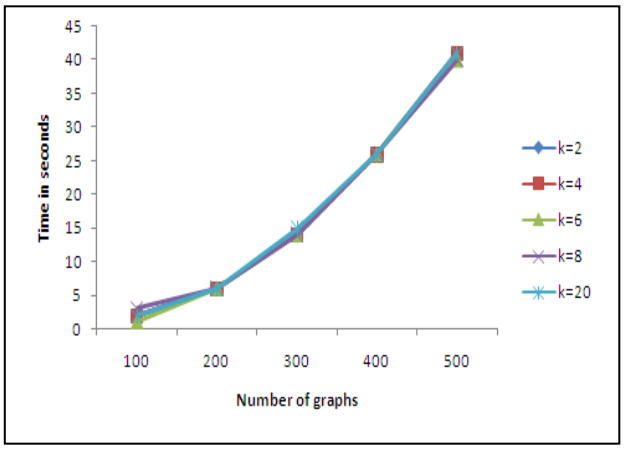

Figure 4. Running time for different k

average density of each graph which is defined as the number of edges in the graph divided by the number of edges in a complete graph. Figure 3 shows the time taken to form clusters where the data set varies between 100 and 500. In experiment 1, the number of centers selected is k=6. Keeping k as a constant, we tested our algorithm on varying number of graphs. We observed that the time complexity of the algorithm increased quadratically with the increase in the number of graphs.

Figure 4 shows the running time of clustering algorithm for a different number of centers and a varying number of graphs. In experiment 2, we tested the algorithm by changing number of graphs and number of centers. Running time of the algorithm increased quadratically as in experiment 1 whose result is shown in figure 3, but the time complexity remained constant for different k value. It shows that running time is independent of k value. Figure 4 indicates that our clustering algorithm time complexity is independent on the number of centers.

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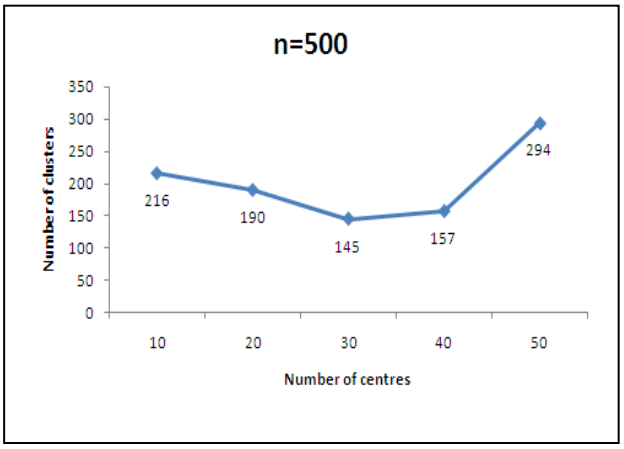

Figure 5. Number of clusters for different k value

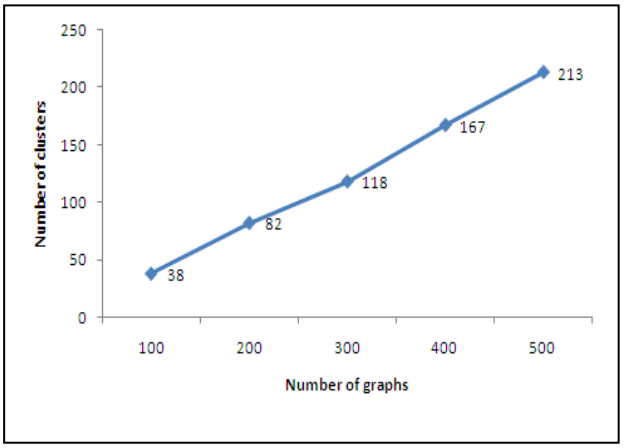

Figure 6. Number of clusters for different n value

In experiment 3, by changing number of centers, we tested clustering algorithm for a database of 500 graphs. In this experiment, we found that, as the k value increased from 10 to 30, the number of clusters reduced from 216 to 145. When k value increased from 30 to 50, the number of clusters also increased from 145 to 294. Figure 5 shows the number of clusters generated for varying number of centers. The number of graphs considered for this experiment is n=500.

In experiment 4, we choose the value of k as 6 and tested clustering algorithm by changing the number of graphs and found the number of clusters obtained. Figure 6 shows the number of clusters generated for varying number of graphs. As the graph data set size increases the number of clusters generated also increases.

VI. CONCLUSION

In this paper, we introduced a novel approach to calculate the graph distances based on the graph degrees. We proposed a clustering algorithm that recursively finds the clusters within a graph data set. We have shown that our algorithm is less sensitive to the number of centers and automatically determines the number of clusters. We conducted several experiments on a synthetic database [16]. In future, we extend our work to study the properties of trees. Trees are a special case of graphs and with appropriate changes, our algorithm is able to work on trees also.

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Affect Feature Analysis in Utterances for Depression Rating

Rekha Sugandhi and Anjali Mahajan

***Abstract*- Behavioral analyses is based on analysis of affects elicited by individuals via modes of body gestures and voice cues. The authors have discussed the roles of such modalities in the study of behavior that indicates presence or absence of depression. The clinical aspects of affect indicators have been taken as reference in the current study. This paper focusses on semantically relating the audio feature vectors to affect that indicate the presence or absence of symptoms of depression in individuals. On the basis of this semantic mapping, the audio feature vectors have been applied on the SVM-RBF kernel to classify the data sets into the appropriate level of depression. On the basis of the classification result, it can be observed that, though not sufficient, the audio features do play a significant role in affect identification and analysis, from comparatively smaller frames of input.**

I. INTRODUCTION

The analysis of human behavior relates to cognitive capabilities of individuals. A computer plays a major role in identifying human affect states based on how a person interacts with computer programs. For instance, positive mood increases self-control and enhances recall of positive incidences. On the other hand, negative emotions adversely affect the human cognitive behavior and response [1]. System designs, based on man-machine interactions, are focused on developing algorithms and interfaces that can assist an individual in using computerized self-analysis. The computer programs interact with users and identify and analyze their moods or sentiments to analyze their affect states and take further actions. A computing system can identify mood indicators in different modalities like facial expressions, gestures and, voice cues, apart from spoken content (linguistic aspect). Therefore, for a computer to be able to work with these modalities, specialized processing algorithms need to be implemented that can convert the real-time multi-modal data into machine understandable form and further accurately analyze them to draw important conclusions based on the input patterns identified by the algorithms [2, 3, 4 and 5].

One such application, being discussed in this paper, is a simplistic model for identification of presence or absence of symptoms related to depression in persons, based on their voice cues. Depression is a common ailment and often goes unnoticed until the mild depression levels in individuals deteriorate into severity. There is a need for flexible interfaces that can aid psychology experts as well as common persons to identify early signs of depression and anxiety. It is also required to design a simple model that can efficiently process complex input representations like audio signals. It is very important to identify significant and relevant audio features from voice inputs. Also equally important is the optimized use of minimal features to get better performance and better accuracy [6 and 7].

Audio feature extraction and analysis has gained immense impetus in the past few years with respect to applications in areas like speaker recognition systems, identification of physiological characteristics in persons, analysis of musical tones and, sentiment analysis. The audio features contain spectral, temporal and spectra-temporal characteristics that give measures of energy level, mood characteristics, speech rate, characteristics of the vocal tract, and variations in pitch [8 and 9]. Feature vectors are represented as low-level descriptors and high-level descriptors. The high-level descriptors represent linguistic characteristics like vocabulary and intonations. The low-level descriptors are composed of hundreds of value-vectors in time-domain as well as in spectral form. Some low-

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level descriptors are: Energy – depicts the loudness of the speech signal computed as the sum of auditory spectrum; Spectral Energy- depicts the sum of the pass-band spectral values; Zero Crossing Rate (ZCR) that represents variations in the signal w.r.t. the zero axe differentiating between noise signals and periodic signals and, cepstral features that measure the frequency components of the signal in the frequency domain [8, 9 and 10].

This paper discusses the few audio features that have been analyzed for identification of affective states in human beings. Section II discusses the related work regarding audio feature extraction and classification in areas of affect analysis. Section III describes the characteristics of audio features that have been analyzed in the current work for purposes of identification of depression levels in individuals. Section IV explains the design of the current work and section V discusses the results of the experimentation.

II. Related Work

Earlier work have indicated high correlation of psychology, affects and human physiology with behavior indication and psychological states. Understanding these parameters help in better diagnosis of common diseases like anxiety and depression. Some studies have also indicated the prediction of likelihood of individuals that may suffer from similar ailments in future, based on such experiments. Symptoms of depression have known to be indicated through behavioral cues like, asynchronous dyadic interactions, aloofness in social settings, pauses in prosodic attributes of speech, and inhibitions observed in facial and body gestures [11]. [7] has stressed on the improvement in performance of automated audio-visual depression detection system, but at the same time focusses on the computational overheads in multi-modal systems, especially in the fusion of individual outcomes of the audio analysis and visual analysis. This work discusses its study of the vocal tract and movements indicated by continuous monitoring of facial expressions help predict the prognosis in young individuals regarding their probability of suffering from depression in future. It also stresses on the need of a generic affect detection system that is invariant to cultural aspects and has stronger semantic analysis than a simple learning model implemented on low-level descriptors of multi-modal input.

[6] describes a system for depression analysis that works on multi-modal inputs. Here, facial movements, head and shoulder movements are considered and spatio-temporal interest points (STIPs) are calculated. The audio features considered are pitch, loudness, intensity and MFCC. The algorithm creates Bag-of-Words (BoW) for audio and facial features. It performs fusions at feature-level, score-level and decision-level. The experiment was conducted on 60 persons of which 30 were patients of clinical depression. This work discusses experimentation on groupings on various combinations on audio and visual feature vectors. The best performance obtained has an accuracy of 91.7%. Due to the tremendous amount of feature vectors that were created as part of the feature extraction, PCA for dimensionality reduction was implemented.

[12] worked on combining acoustic and linguistic features extracted from German database of children interacting with a robot in which the SVM (linear kernel), sequential minimal optimization, and Random Forests for classification of the data into emotion states were employed.

The total of 4244 features were pooled and grouped into 12 Low Level Descriptors (LLDs) and 6 functional types.

This work attempts to find optimal independent set of features to be able to classify. Based on the interaction between the children and the robot, the spoken words (by the children) were annotated by three or more observers,

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and the phrases were assigned affect labels based on Majority Voting (MV). This research helps draw conclusion that amongst the acoustic features, speech energy and duration have the highest relevance in the analysis while voice quality is least relevant. Also, amongst the linguistic features, bag of words (BoW) have the highest relevance and semantics and POS modelling have higher than medium relevance. These features are extracted better by SVM than by random forests (RF). In the work presented in the current work, the SVM classifier has been used.

In an earlier work in audio analysis, four feature sets have been analyzed and learnt for classification. These feature sets are Standard Low-level, MFCC, psychoacoustic (roughness, sharpness and loudness) and, acoustic features temporal envelope (AFTE). The audio databases include Speech and Music files from various genres. The classification has been applied on static as well as static-temporal features. The latter gives better prediction accuracy. In this work, the Gauss-based quadratic discriminant analysis (QDA) has been implemented along with feature extraction and training. Cross validation has been performed using the .632+ bootstrap method. Bootstrap replication was done 500 times for each class. The audio database used for learning is not extensive enough. The clusters in the feature space have been assumed to be Gaussian shaped. But this assumption has not been completely validated. Also, different classification scheme could be tried for the prediction analysis [11].

[13] is based on a fusion method of extracting emotions in terms in valence, activation and dominance. The input to the classification and fusion is in the form of speech and visual captured images from the IEMOCAP database that contains dyadic interactions. The authors have considered classification of emotion attributes for multi-modal multi-temporal input at varying temporal lengths. Three classifiers at 400ms, 800ms and utterance-level have been employed for emotion prediction into one of the three states i.e. calm, neutral and, excited. The classifiers for both modalities i.e. speech and visual have been implemented. For emotion-feature analysis, the speech features that have been monitored are energy (loudness), spectral energy, pitch, formant (18 LLDs) and voicing (F0, probability of voicing, HNR, jitter (local, delta), shimmer (local) and, zero-crossing rate) apart from 53 motion capture features. The most significant features were ranked using the SVM sequential forward selection algorithm. The technique works best for activation and second best for valence, but though improvement shown, not very significant for extraction of dominance. The method works well but is computationally intensive.

III. Relating Affects/Speech features to Indicators of Depression

Audio features in the form of signals contain vast information that needs to be extracted depending on the type of information that is needed [8, 9, 10, 11 and 12]. Majorly the audio features contain:

- Temporal features (in time-domain)- energy envelope characterization, auto-correlation
- Spectral features (in frequency domain)- Mel-frequency Cepstral Coefficients (MFCC), spectral energy
- Spectral-temporal features- formants, energy transitions
- Prosodic features- fundamental frequency (f0), formants, pitch, Zero-Crossing-Rate (ZCR), speech –rate and intensity (proportional to loudness)

Varying groupings and combinations of extracted audio features assist greatly in the assessment of mood and affects in human subjects. For the case study in consideration, i.e. affects indicating signs of depression in persons,

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the extracted feature values can be associated with presence or absence of traits indicative of depression. In this article, the DSM-V Standard and the Hamilton Rating Scale for Depression is being referred. [15, 16, 17 and 18] are standards that are universally accepted and followed by psychiatrists and psychologists. As per these classified standards, depression as a state of mind can have few indicators through speech. If the features are extracted from voice samples of depressed persons, it is found that the fundamental frequency, f0, has a lower range and the energy level is usually lower in terms of loudness and intensity as well. Mood swings can be related to features like ZCR and energy transitions. Other important feature indicators that have been considered are low pitch, MFCC and low speech rate. As compared to pitch, MFCC (short-term spectral feature) is more sensitive to the content. Hence, MFCC and prosodic features are complementary in feature extraction, especially for affect recognition systems [6, 10 and, 12].

IV. Design Description

A. Dataset Description

The dataset included in the current work for affect identification are basically in the form of video files and audio files. About 52 video files have been taken from youtube.com based on interaction with persons experiencing varying degrees of depression and have been clipped into shorter video clips of an average length of 50 seconds. The total duration of all the videos is approximately 43 minutes with 9 male and 7 female participants. The video clips include monologues of six participants, six instances of dialogues and two group interactions. The video clips have been segmented to have only one participant in each video clip.

In addition to these videos, 430 audio clips of utterances have been created through voices of actors that mimic varying emotions. The voice clips have an average duration of 15 seconds. The audio clips are monologues that involve 29 participants out which there are 16 male voice recordings.

In the current study, the database has been annotated and manually rated for both individual affects and the total score indicating the presence or absence of depression. The score assigned to each of the affects with ranges are as listed in Table I.

TABLE I
LISTING OF ANNOTATED AFFECTS WITH THEIR SCORE RANGES

Affects	Score ranges	
	Minimum	Maximum
Agitation, Anxiety, Fatigue, Happiness, Hopelessness, Neutral, Sadness	0	4
Guilt	0	2

TABLE II
ANNOTATION CATEGORIES

Score ranges	Category Assigned
0 to 3	No Depression
4 to 8	Mild Depression
8 to 12	Moderate Depression
13 to 18	Severe Depression

The database has been annotated and manually rated, by observers, between 0 and 4 for all affects except for guilt that has a possible score range between 0 and 2. The total score of all the individual ranks are added up to give the

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final score that has a possible value between 0 and 18. Based on this score the clip is categorized into one of the classes as listed in Table II.

The video and audio clips have been annotated by three volunteers (out of four) and have been validated by two psychology experts. In the video clips, out of the 16 participants, 8 participants have been marked by the annotators as having No Depression, while the remaining 8 participants have been annotated under varying scales of depression i.e. between values 4 and 18. Also, in the audio utterances, out of the 29 participants, 12 participants have been marked by the annotators as having No Depression, while the remaining 17 participants have been annotated under varying scales of depression i.e. between values 4 and 18 [19 and 20]. Thus, the combined video and audio database participants have been categorized as 20 normal participants and 25 participants showing more or less signs of depression.

The current work is part of a multi-modal affect analysis system that also involves linguistic and gesture analysis [21]. All the recordings and clips are in English. The dataset described above is a preliminary one that will be extended further. From the view of analyzing different modalities, video clips as well as audio inputs will be assessed. Video clips have the advantage of containing information in the form of gestures, expressions, audio features as well as linguistic content. This paper only focusses on analysis of audio affect features.

B. Architecture

The system design focusses on extraction of speech features and mapping the relevant features to human affect indicators. The major steps involved are as below:

1. The audio clips are segmented into smaller clips of average duration of around 40ms, with an overlap of 10ms with the temporally adjacent clips.
2. For each audio clip segment the following steps are applied:
    a. *Pre-processing and Feature Extraction*: The speech signals need to be conditioned for successful extraction of the speech features. The pre-processing tasks necessarily involve pre-emphasis, framing, windowing (in this work, Hamming windowing with $\alpha = 0.54$ has been implemented) and, FFT Mel Frequency wrapping. [8] explains the pre-processing module step-wise. The pre-processed audio signals are then input to the *Feature Extraction module*. The sampling period for feature acquisition is *2.26e-005 seconds* to ensure recording of the smallest variation in the sound features. The python open libraries *scipy, wave, numpy, and pylab* have been used for the audio feature extraction. The extracted features are energy contour-median, pitch-median, pitch-standard deviation, ZCR, Format F1 and MFCC. The tool *Praat*, has been used for comparing the values of extracted pitch, intensity, energy contour and Formant 1 values [22].

    For the meaningful mapping of the extracted features to the affect indicators of depression [23], the features ranges (low and high) have been explicitly associated with modified affects that relate to signs of depression as per the Hamilton scale. Also, as per the Russell circumplex model [24 and 25], the state of depression when plotted on the valence-arousal 2D-scale indicates midranges of negative valence and in-activity. On the basis of this model, Table III indicates the mapping relative

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to the feature values. This table has been referred for verification of the outcomes of the classification performed in step 2b.

TABLE III
DERIVED MAPPING OF FEATURE VALUES WITH DEPRESSION LEVEL

Audio Feature Parameters	**Major Indicators for Hamilton Scale for Depression**	
	Low	**High**
Median of Energy Contour	Feeling of sadness Feeling of guilt Fatigue Hopelessness	Anxiety Agitation
Pitch Contour- Median	Feeling of sadness	
Pitch Contour- Standard Deviation	Feeling of sadness Hopelessness	Anxiety Agitation
ZCR	Feeling of guilt	Anxiety
Formant 1	Feeling of sadness Fatigue Hopelessness	Anxiety Agitation

Note: This table includes only affect-related indicators for Hamilton Depression scale. Therefore depression indicators based on psychomotor -based symptoms, somatic and physiological indicators are not evaluated here.

b. *Feature Scaling and Feature Vector Classification:* The extracted values in the feature vector have very small variations. Hence, to ease the classification, the feature vectors have been scaled up by a constant fold of 1000, so that the range of values in the feature vector are increased to be suitable for classification. The scaled feature vectors are then classified using the Support Vector Machine (SVM) classifier with the *RBF-kernel*. The audio clips are classified into one of 4 classes of depression scales namely, *No Depression, Mild, Moderate or High*.

3. Affect Integration and Resolution: Since an audio clip has been split into segments of 40ms each, these segments are temporally ordered for the integration of individual classified depression levels. The individual classifications for each segment are checked for major variations in the classification result. The integration of the overall affect level for an utterance is evaluated as the weighted average of the classifier values of each individual segment, where the weights are multiplied in increasing order of frame sequence.
The four classes assigned to each classified frame have been enumerated as below:
{No Depression = 0, Mild Depression = 1, Moderate Depression =2, High Depression = 3}
So, for an audio clip with '*n*' frames, if the affect ratings are $r_1, r_2, r_3, \ldots, r_n$ and the weights attached to the ordered frames are $w_1, w_2, w_3, \ldots, w_n$, then the overall rating of one audio clip is evaluated as:

$$R = round(mean (\sum_{i=1}^{n} w_i r_i))$$

Here, weight assigned to first frame is $\mathbf{w_1 = 1}$, and subsequent frame weights are calculated as incremental weights on weights of previous frames i.e., $w_{i+1} = w_i + n^{-1}$.

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In order to normalize the addition of incremental values of weights the *mean of the sum* is evaluated to give the final utterance rating. The rounding operation converts the final utterance rating into an integer represented the final classification category. The justification for the temporally increasing associated weight is that the last classifier is assumed to represent the lasting affect state of a person.

V. Result and Analysis

There are a total number of 482 utterances (audio) in the combined dataset, in which the audio extracted from the video files have an average duration of 50s and the pure audio files have an average duration of 15s. Each of these clips have been segmented in sub-clips of 40ms each with overlaps of 10ms with adjacent clips.

A. Dimensionality Reduction

A very small sampling time of *2.26e-005s* ensures capturing maximum features. At the same time, to reduce the computational costs, rather than performing the analysis of thousands of feature vectors, the energy contours, pitch median and standard deviation has been analysed for the classification. The feature vectors for a frame of 40ms is aggregated for energy level and pitch values and for ZCR, and Formant value F1, the mean has been evaluated over all the samples within the frame. The perception considered here is that the audio parameters have less variations in a small interval of 40ms.

B. Test Results

In order to maintain the context of the affect state, the integration of the individual classes of each segment have been combined with other segments of the same original clip, but in temporal order, as explained in step 3 of previous section. Of the total dataset, the training was performed on 60% of the utterances and the remaining 40% was tested. The training and testing datasets were pre-classified by annotation into one of the four classes namely, No Depression, Mild, Moderate or High. The performance metrics as the outcome of the testing phase of the depression-level classification is as shown in Table IV.

Table IV
Performance Metrics for the Classification

		Predicted				
	N = 97 (test sets)	**No Depression**	**Mild Depression**	**Moderate Depression**	**Severe Depression**	**Recall (%)**
Actual	**No Depression= 32 cases**	29	2	1	0	90.6
	Mild Depression= 26 cases	3	23	0	0	88.46
	Moderate Depression= 27 cases	0	3	20	4	74.07
	Severe Depression= 12	0	0	2	10	83.33

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	cases					
	Precision (%)	90.6	82.41	86.95	71.4	**Accuracy = 84.53%**

Though the accuracy for the classification of the dataset is 84.53%, the precision for *severe depression* was found to be comparatively less, since the range of intervals for the mapping function was too marginal. Since this work is a part of multi-modal analysis system for affect detection, it is expected that the precision in each classification will improve when the results of text and image analysis are fused with the classification obtained in the current work.

VI. Conclusion and Future Scope

The linguistic i.e. text feature extraction classifies high level features such as vocabulary, accents, repetitive contents or patterns; also certain symptoms can be extracted only through speech content (linguistic) analysis, that pertain to negative affects like *suicidal tendencies*, *anxiety*, verbally expressed feelings of *hopelessness*, that are related to depression. Also, the analysis of only audio features was unable to identify *guilt* and *obsessive impulsive behavior*, if present, in the depressed subject. Therefore, for a more accurate affect analysis, linguistic features of speech content needs to be necessarily extracted and classified. The integration of the speech, image and linguistic feature analysis is currently under progress, and it is estimated that the accuracy in the case-based analysis will greatly improve in the multi-modal setup. As the future scope, dialogues and group interactions will also be considered for optimizing the feature extraction and classification of the spectral-temporal parameters.

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Assessing component based ERP architecture for developing organizations

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***Abstract*-Various aspects of three proposed architectures for distributed software are examined. A Crucial need to create an ideal model for optimal architecture which meets the needs of the organization for flexibility, extensibility and integration, to fulfill exhaustive performance for potential talents processes and opportunities in the corporations a permanent and ongoing need.**

The excellence of the proposed architecture is demonstrated by presenting a rigor scenario based proof of adaptively and compatibility of the architecture in cases of merging and varying organizations, where the whole structure of hierarchies is revised.

Keywords: ERP, Data-centric architecture, architecture Component-based, Plug in architecture, distributed systems

I. Introduction

Customers' requirements control the creation and deployment of software. Customers demand more and better functionality, they want it tailored to their needs, and they want it "yesterday." Very often, large shops prefer to develop their own in-house add-ons, or tweak and replace existing functions. Nobody wants to reinvent the wheel, but rather to integrate and build on existing work, by writing only the specialized code that differentiates them from their competition. Newer enterprise-class application suites consist of smaller stand-alone products that must be integrated to produce the expected higher-level functions and, at the same time, offer a consistent user experience. The ability to respond quickly to rapid changes in requirements, upgradeability, and support for integrating other vendors' components at any time all create an additional push for flexible and extensible applications.

Down in the trenches, developers must deal with complex infrastructures, tools and code. The last thing they need is to apply more duct tape to an already complex code base, so that marketing can sell the product with a straight face.

Software Architecture [31; 32] describes the high-level structure of a system in terms of components and component interactions. In design, architecture is widely recognized as providing a beneficial separation of concerns between the gross system behavior of interacting components and that of its constituent components. Similarly this separation is also beneficial when considering deployed systems and evolution as it allows us to focus on change at the component level rather than on some finer grain.

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II. Software architecture

Architecture is the fundamental organization of a system consisting of components, each of which is associated with each other and with the system and the principles governing its design and evolution. Software architecture in fact is the selection of a general structure for implementing a software project based on a set of user requirements and business of software systems in order to be able to implement the intended applications and also to optimize and accelerate the quality of software, its production and maintenance. Nowadays due to the development of distributed systems that are constantly changing, the need for a flexible architecture can be felt more than ever [28].

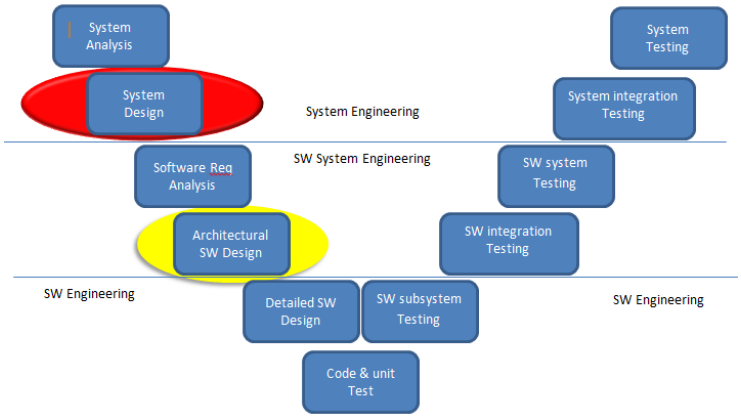

Figure 1. Architecture: place in system development cycle [28].

III. ERP

Enterprise Resource Planning (ERP) programs are core software used by companies to coordinate information in every area of the business. ERP programs help to manage company-wide business processes, using a common database and shared management reporting tools. A business process is a collection of activities that takes one or more kinds of input and creates an output, such as a report or forecast that is of value to the customer. ERP software supports the efficient operation of business processes by integrating throughout a business tasks related to sales, marketing, manufacturing, logistics, accounting, and staffing [4, 5].

Integration is one of the major objectives of ERP systems, within the company, between functions or departments, but also outside the company, between business partners like customers, distributors, suppliers or sub-contractors. But what is integration? Through definitions shared by management and computer sciences, it is often considered as creating a seamless flow of materials, finances, information and decisions in order to decrease waste due to multiple loose interfaces between islands of efficient activity processing. According to such definition, information system integration is closely related to the efficiency of the business processes inside and between firms [4, 5].

IV. Architectures for development of Software distributed

A. Data- centric architecture

The goal of this architecture is to maintain the integration and the ability of aggregation. The word “data-centric” refers to systems in which the availability and timeliness of the data is an appropriate descriptive of

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system performance. A client runs on a set of independent control field and common data that is accessed by all customers and it can be as a passive source (such as a file) or an active source (blackboard).
The concept of association can refer to two groups:

1. Common data acts as a passive source (such as a file)
2. Common data acts as an active source (such as a blackboard)

The blackboard, against the passive source, sends massage to customers at the time of changing data so it is active. By having a blackboard in this style, its shape would include arrows that can be derived from the shared data. The architectural style is always expanding and improving importance and this is due to the existence of a structural solution for achieving integration capabilities. In many systems, especially systems of pre-built components, data integrity is provided by mechanism of the blackboard. In this style, a major advantage is that customers are available as independent from each other and common data is an independent part of the customer. Therefore, this style is scalable and can easily add new customers.

This style has high corrigibility too and it's due to the possibility of change of each customer is having no effects on other customers. In this style, if a connection is established between the customers, in spite of the fact that it will reduce corrigibility, it increases the efficiency [23].

B. Architecture Component-based

Software components are a comprehensive and extendable piece which its function is well defined. Through interfaces with other components can be combined and interact with each other. Three goals of component-based architecture include: Overcoming complexity, manage the changing, re-usability [9,10].

C. Plug in architecture

Plug-in architectures and platforms represent a promising approach for building software systems which are extensible and customizable to the particular needs of the individual user, However, there are several technical features which have contributed to the success of plug-in systems: [16,17].

- Plug-in components are coarse-grained, i.e., they are like small applications with features which are of direct value for the user. In that, they are mainly self- contained and have limited dependencies on other components.
- There are clear rules on how to specify dependencies and interactions between components. This results in precise documentation on how systems can be extended and how plug-ins shall interact.
- Working environments can grow in a disciplined and determined manner allowing the users to create their individual working environments by selecting from a set of plug-ins [19,22].

V. Measurement and analysis of the architecture criteria

A. Layout of components:

Components, as the original block and computational entities participating in the construction of system through internal computation and external communication do their choruses. Every component communicates with

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environment by one or more port. A user interface can be a common variable; the name of a procedure which calls from other component; it is a set of events that can occur as a component and other mechanisms. Properties of a component, specifies data for analysis and software implementation.

B. Create

Configuration is a connected graph which is sometimes referred to as the topology composed of components and connectors and describes the structure of architecture.

C. Connection

When connector makes a connection between two components, component defines an interface. And every component can have several interfaces. An interface is concerned to just one component and every interface of one component can connect to several interfaces in other components. For example in Bus-Oriented architecture the interface of every component is connected to the bus connector and so it will be connected to several interface in other components. Attributes can also be indicated by some of the features, such as communication, buffering capacity and so on.

D. Development

Development and promotion in computer systems will cause the development and software update. Therefore an important metric that can be considered in the selection of the architecture is extensible metric. The software architecture must be extensible. We evaluate it since this metric has a major role in architecture.

E. The main advantage

Each of software architecture has advantages compared to other architectures. The software architecture eliminates defects in other architectures and complements previous architectures.

F. The main problem

Although each of software architectures is trying to be the best and perfect, but, in spite of the development and expansion of information systems, they are still facing problems and in some cases, some complications faced.
These criteria were chosen only for the problems and shortcomings of Distributed software development architectures and of course there are other factors and criteria that are not effective in this research. To see a full description and explanation of software metrics can be [M. Shaw and D. Garlan, 1996] presented [27].

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VI. Compare architectures

Table I
Compare architectures.

Architecture	Data- centric	Component	Plug in
Layout	Data is stored in a database and a common data is accessed by all customers [24, 26].	Components are integrated and modular, A unit is independent establishment and is independent of other components A unit of independent deployment [12,14]	They are placed in the outer layers of software [22].
Creation	The architecture emphasizes the accessing and updating data [24, 26].	Special languages for defining interfaces, (IDL).[11,12] There's a lot of software components 1.Input/output types 2.Functional behavior 3.Concurrent behavior 4.Timing behavior 5.Resource usage 6.Security[11,15]	The plug-in creates a configuration file is executed and all the settings will be in the file [22].
Connection	The connection is established in two ways: When the shared data, as a passive source, acts like file. When the shared data is as a blackboard [24, 26].	IPC protocol IIOP (Internet Inter-ORB Protocol)[12,11] Not context dependent Not related to a specific area and can be used in the system [15]	In this architecture, plug-connected to the outer layer software [21].
Development	**It** has high Corrigibility Due to the change of each customer having no effects on other customers [24, 26].	Components are interchangeable for example component B can be replaced with component A Compassable with other components A good combination of mechanisms is used [14,11]	Plugins can be deployed globally or only for a specific environment and not limited in its development. [19,20].
Elected or a combination of other architectures	It's not selected from another architecture[26].	The conference was published in Germany in 1968,is not selected from other architectures [9,10]	This function is a component-based architecture [22].
The main advantage	The data integrity is provided by mechanism of blackboard and common data is an independent part of the customer. Therefore, this style is scalable and can easily add new customers [24, 26].	Reuse of software in order to reduce development costs Variability, performance, Support for parallel distributed systems on runtime [15].	It will active Customization with attention to user's needs Simple and Powerful Its structure is such that the position of other plugins can use functions [18].
The main problem	In this style if a connection is established between the customers In spite of the fact that it will reduce Corrigibility, it will increase the efficiency [24, 26].	Data integration components can be hard to combine.[12]	Database is not a suitable place to store configuration information [21].

VII. Problems architectures

The feasibility survey was conducted for exploring attitudes of the users and potential customers. It showed that main obstacles which hinder usage of service are related to possible cloud service termination or failure and vendor lock-in. [1] the rule engine component enables to inform the customer. If he can retrieve the data batch from cloud in the required format and ensures possibility to use the backup data with the local system of the customer and prevent from vendor lock-in situation.[1] Availability, data lock-in, data confidentiality and auditability are the obstacles which affect adoption of cloud computing.[2] Although cloud computing providers are facing several architecture and design challenges, however, security concerns,

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interoperability, data lock-in are on top of those challenges. Most of the clouds are vendor-locked, as several cloud providers offer APIs (application programming interfaces) that are well-documented, but are mainly proprietary and exclusive to their implementation and thus not interoperable[3]
For 20% of the respondents, risk of vendor lock in, loss of control, and security were sources of concern. The ability to meet government and industry standards was not seen as a concern, as none of the respondents selected this option.[6] Now, certain characteristics of this alternative make it attractive for SMEs: greater adaptability, no vendor lock-in, property of the source code, and cost comparable to other alternatives .[7] This last problem has been further pursued by IS researchers who have looked at package customization and organizational adaptation as alternative ways of resolving such misalignment[7]

At present, there are many companies implement Enterprise Resource Planning (ERP), some companies choose to buy the ERP software directly, or hire the professional group coding software for the companies. However, due to the poor flexibility of the system, and not very appropriate for business processes and management concepts, Some companies hitch have lots of profits choose to self-development the ERP system.[8] ERP system change the business process of the enterprises, and it is difficult to personnel adapt to the new system, as a result, it will also prolong the whole time in ERP implementation.[8] In this condition, the system can better focus on needs of users. How to solve these business problems and technical details will be completed through the conversion tool. Although the definition of the conversion is difficult, when business needs changes, it can be used again. In the long run, this effort has positive effect to the rapid development. [8]

By analyzing the existing systems and considering the resources that have pointed to these problems and complications, the complications that architecture is not accountable for them, are as follows:

1. Extensibility problem involving (the laws that have been changed, change in data, the changes in the organization, integration, change in operations, changes in systems, developing new systems).

2. Problem of imprisonment or trapped data.

3. Programmer locked-in problem, the only programmer can develop the system further.

To solve the above problems, there are solutions which are listed below:

One effective way to make your application extensible is to expose its internals as a scripting language and write all the top level stuff in that language. This makes it quite modifiable and practically future proof (if your primitives are well chosen and implemented). A success story of this kind of thing is Emacs. I prefer this to the eclipse style plugin system because if I want to extend functionality, I don't have to learn the API and write/compile a separate plugin. I can write a 3 line snippet in the current buffer itself, evaluate it and use it. Very smooth learning curve and very pleasing results.

One application which I've extended a little is Trace. It has a component architecture which in this situation means that tasks are delegated to modules that advertise extension points. You can then implement other components which would fit into these points and change the flow.

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But due to the distributed systems need database, these solutions can't be hopeful way. Like most things in life, taking the time to plan ahead when building a web service can help in the long run understanding some of the considerations and tradeoffs behind big websites can result in smarter decisions at the creation of smaller web sites. Below are some of the key principles that influence the design of large-scale web systems:

Availability, Performance, Reliability, Scalability, Manageability, Cost

VIII. Separation-of-Concerns (SOC)

A key principle of software development and architecture is the notion of Separation-of-Concerns. At an architectural level, separation of concerns is a key component of building layered applications. In a traditional N-tier application structure, layers might include data access, business logic, and user interface. More modern N-tier application designs might include a core domain model and separate infrastructure modules in addition to one or more front end services and/or user interfaces. Web pages, to a greater or lesser degree, separate concerns relating to structure, logic, and formatting through the use of HTML, JavaScript, and CSS. At a lower level, the networking model used by the Internet is broken into a series of layers each with specific concerns and responsibilities, and demonstrates how separation of concerns can be effectively applied [29].

In addition to separating logic across programming layers, one can also separate concerns along application feature sets. Applications may be written to allow functionality to be added or removed in a modular fashion, and many commercial products support this functionality as a means of separating features across product SKUs or to allow third parties to create plug-ins.

Separation of Concerns tends to be a natural consequence of following the Don't Repeat Yourself principle, since of necessity abstractions must be built to encapsulate concepts that would otherwise be repeated throughout the application. As long as these abstractions are logically grouped and organized, then Separation of Concerns should be achieved [30].

IX. The proposed model

This architecture made of combining Data- centric architecture, plug-in architecture and component architecture so that in this architecture all components are connected to the data center but the components must appear with two hands (it is getting from plug-in architecture with this innovation that both hands SERVICE INTERFACE and Plug in interface added to every component. It means components have two hands instead of one hand). So in addition to connection they can transfer services and data.By using SOC discuss we concluded that every component must maintain its own data and just Common data such as Authentication and etc. will be kept in Data- Centric. We called the proposed architecture, CPDC Architecture which contains bellow parts:

- **Data center:** Information in the data center, public data, such as user categories, authentication and organizational chart of the organization need to be placed in the center.
- **Service interface:** An interface to transfer services from one component to another component
- **Plug in interface:** Certain protocol for connecting components
- **Service:** Services and operations that are performed on the data in each module
- **Plug in manager:** management, control and configure of plugin will done.

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- **Specific data:** Data that is for a special system and there is no need to exist in other systems.
- **Host component:** The various modules which are available in the organization

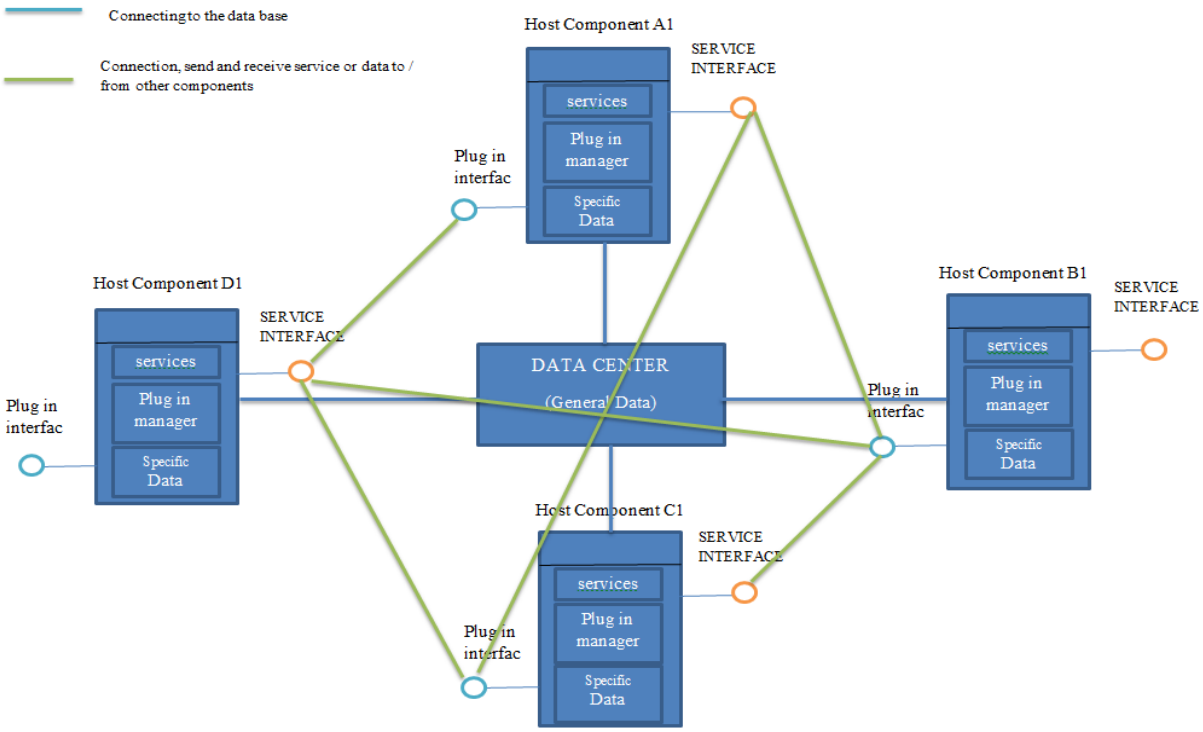

Figure 2. proposed model, CPDC Architecture.

X. Evaluation and testing the soundness of architecture

As the defense of the accuracy of the answers to the problems and requirements mentioned in the introduction and motivation for the proposed architectural design should examine it from different aspects, and Shown that in each of the scenarios change, development, merging, etc. is acting correctly.

A. Extensibility SYSTEMS

In the first problem of the development system and add a new system to program in a way that the integration didn't lose; If you use CPDC Architecture model, we can easily add a system to our organization system and the new system is able to transfer data.

Now, adding a new system to organization with the following two approaches:

First approach: similar systems exist in the organization so they can merge together and in the format of the old system used in organization. In this approach, the following steps are performed. The proof is shown in Figures 3 and 4.

First step: adding processes of both systems in a single system

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Second step: adding Specific data of both system in a single system

Third step: adding services of both system in a single system

Forth step: the aggregated system should connect to the data center

Fifth step: management of new and old systems must be removed and a single management stays on aggregate systems.

Merge integration (Org, New Host ComponentA2)

Host Component A=Merge (New Host Component A2, Host Component A1)

Merge (Manager New Host Component A2, Manager Host Component A1)

Revoke Privileges Manager New Host Component A2 → Grant Privileges Manager Host Component A

Revoke Privileges Manager Host Component A1

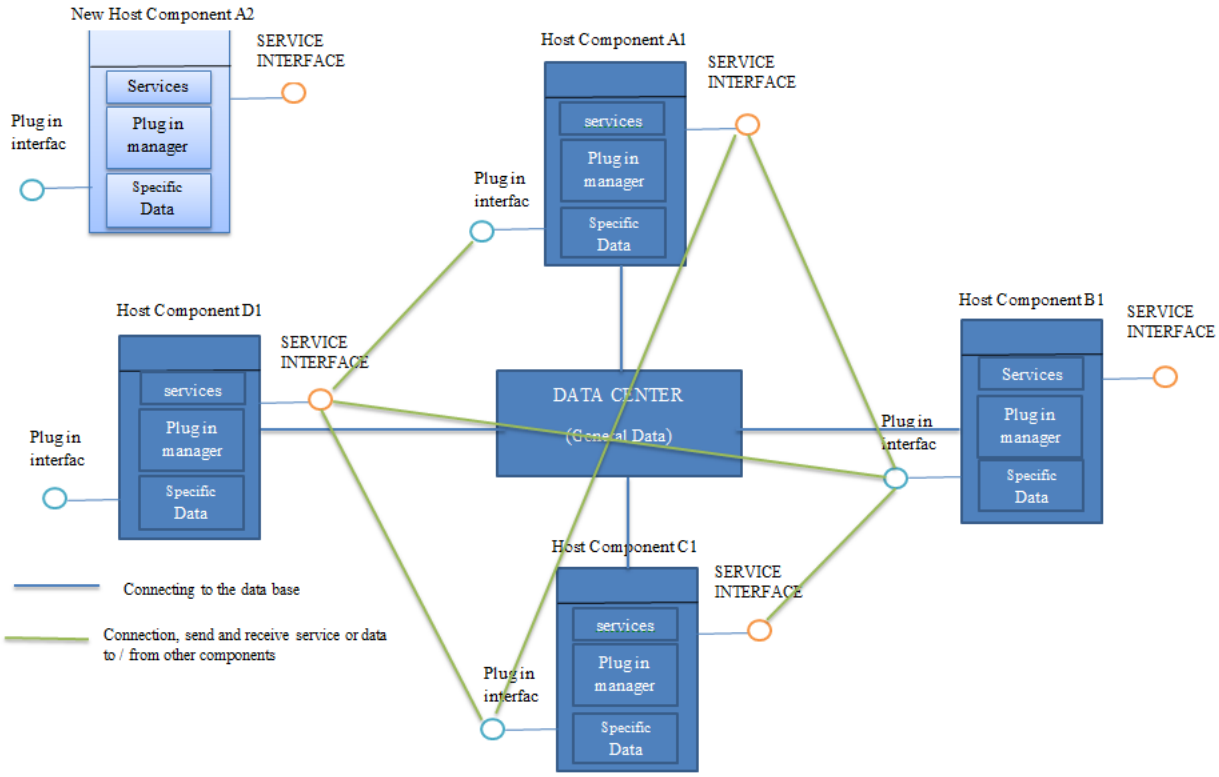

Figure 3. Add a system to organization which can merge with one of the systems.

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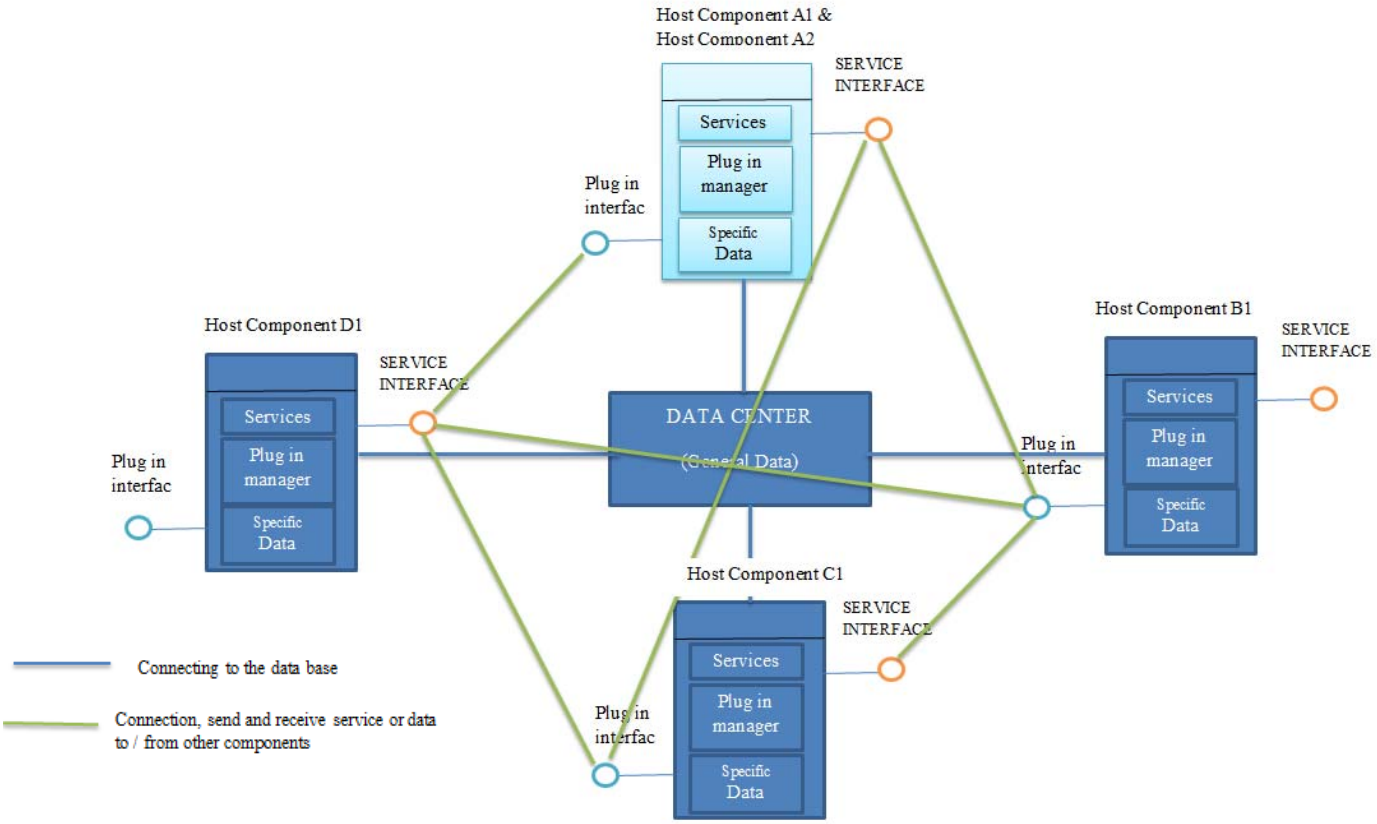

Figure 4. Extensibility System of CPDC Architecture.

1. The second approach is that the new system does not exist in the organization and should fully be added as a new system, these steps can be done in this approach.
   Step One: with adding a new system to organization it should be connected to the data center to authenticate from data center

   Step Two: If the new system wants to connect to other existing systems, it can use both hands plug in interface and service interface, so after the connection they can send and receive data. The proof is shown in Figures 5 and 6.

   The third step: defining the management of new system in the organization

Merge integration (Org, New Host Component F2)

Host Component F=Merge (Host Component F1, Host Component F2)

Merge (Manager Host Component F1, Manager Host Component F2)

Revoke Privileges Manager Host Component F1 → Grant Privileges Manager Host Component F

Revoke Privileges Manager Host Component F2

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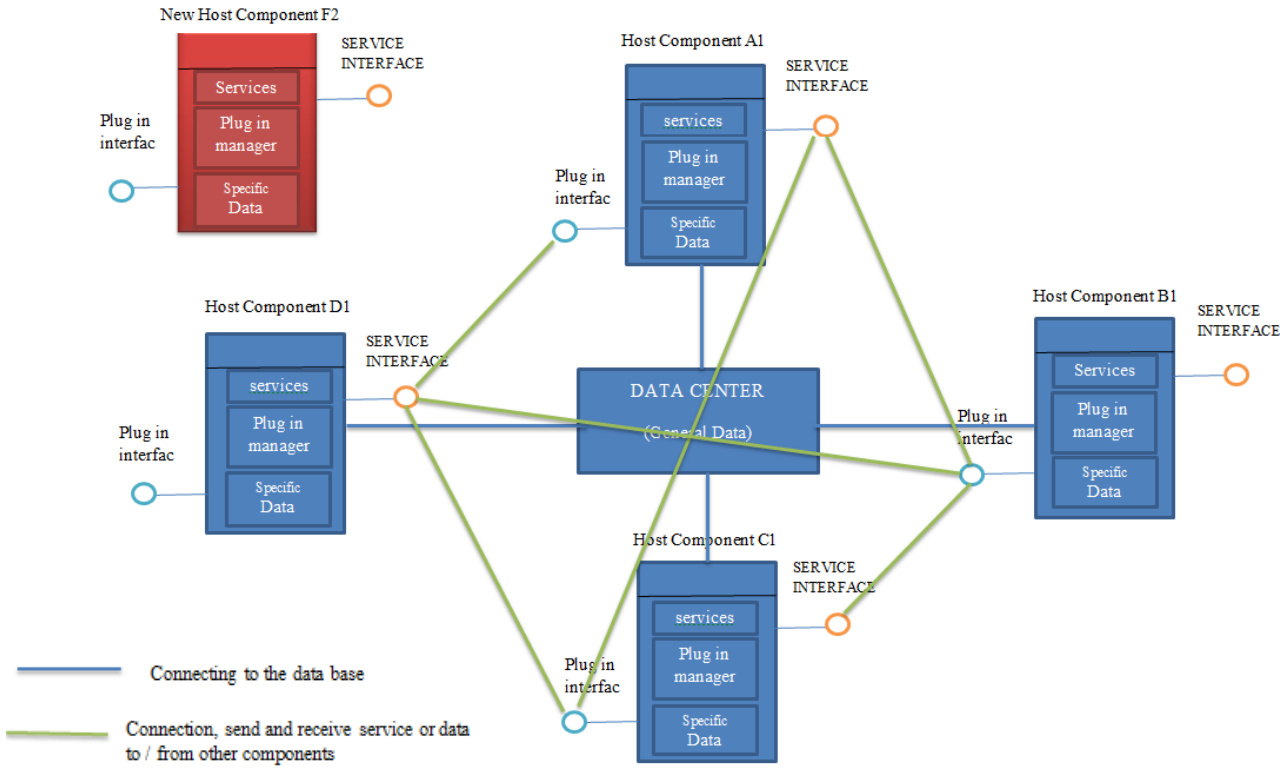

Figure 5. Add a system to organization which cannot merge with another system.

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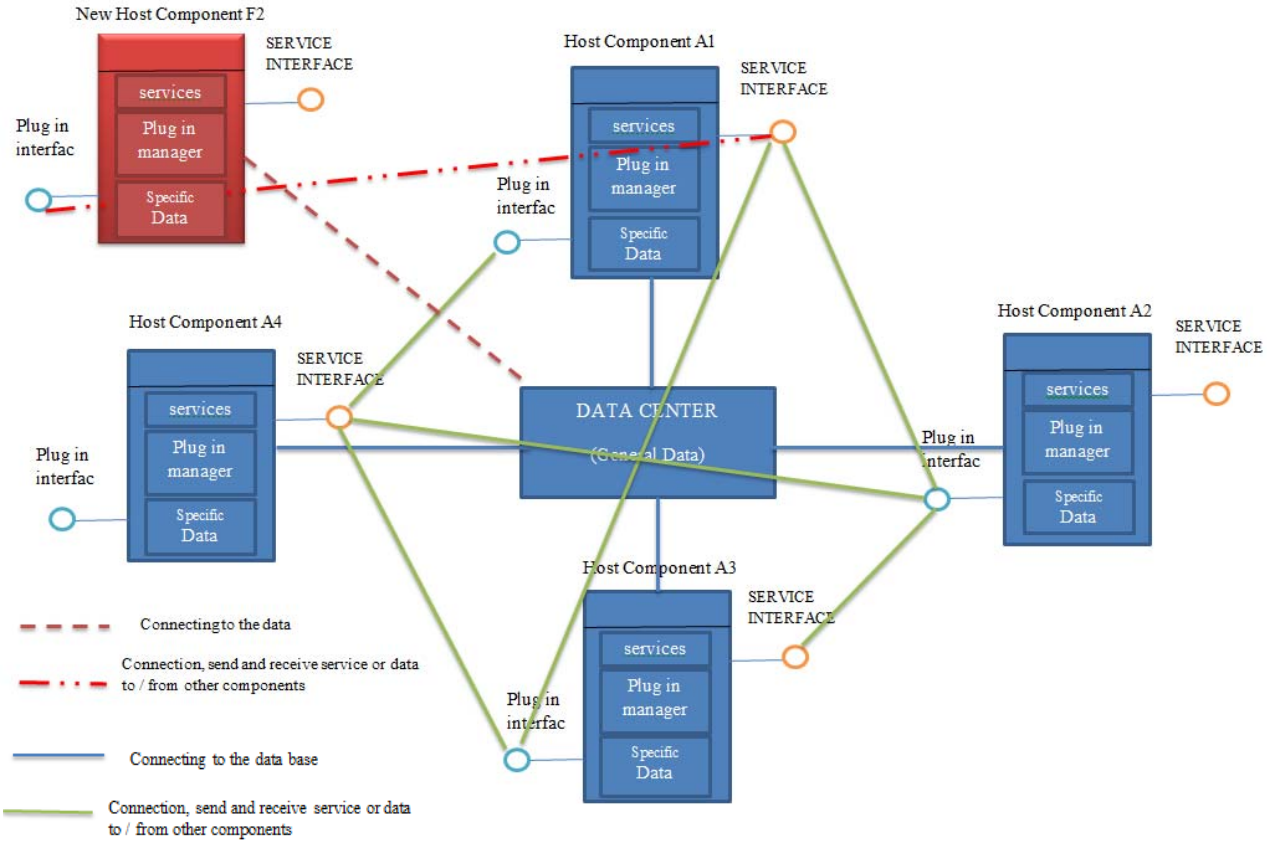

Figure 6. Extensibility System of CPDC Architecture.

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Algorithm Extensibility SYSTEMS

Input: A new subsystem and all the relationships with other subsystems and all the relationships in an org

Output: A new extensibility system

1. Org ⟵ organization;
2. I ⟵ New Host Component;
3. J ⟵ Similar subsystem in org;
4. Q ⟵ (merge I&J);
5. If I equal J;
6. Do merge I and J;
7. specific data of Q ⟵ Merge specific data of I with specific data of J;
8. services of Q ⟵ Merge services of I with services of J;
9. Add Q relation with data center;
10. Revoke Privileges Manager I;
11. Revoke Privileges Manager J;
12. Grant Privileges Manager Q;
13. End if.
14. If subsystem Q need to connect with other subsystem;
15. Add relation between plug in interface Q and other subsystem service interface;
16. Else
17. Add I relation with data center in org;
18. Grant Privileges Manager I;
19. End if.
20. If subsystem I need to connect with other subsystem;
21. Add relation between plug in interface I and other subsystem service interface;
22. End if.
23. End.

B. The merge of the two organizations

The problem of merging two organizations can keep integration in organization and merge all systems by using CPDC architecture. Some systems such as Host component A2 and Host component B2 are common with Host components of other organizations will combine to gather, they work the same in both organization, systems that are different must first be separated from the previous data- centric and connect to new data- centric, then they can connect to each of necessary systems of new organization with both hands SERVICE INTERFACE and Plug in and transfer data. So the new processes will be defined easily by systems of new organization. The proof is shown in Figures 7 until 12.

Merge integration (Org1, Org2)

Data Center = marge (DataCenter1, Data Center2)

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Host Component A=Merge (Host Component A1, Host Component A2)

Host Component B=Merge (Host Component B1, Host Component B2)

Host Component C=Merge (Host Component C1, Host Component C2)

Host Component D=Merge (Host Component D1, Host Component D2)

Host Component E=Merge (Host Component E1, Host Component E2)

Host Component F=Merge (Host Component F1, Host Component F2)

Merge (Manager Host Component A1, Manager Host Component A2)

Revoke Privileges Manager Host Component A1

Revoke Privileges Manager Host Component A2

Grant Privileges Manager Host Component A

Merge (Manager Host Component B1, Manager Host Component B2)

Revoke Privileges Manager Host Component B1

Revoke Privileges Manager Host Component B2

Grant Privileges Manager Host Component B

Merge (Manager Host Component C1, Manager Host Component C2)

Revoke Privileges Manager Host Component C1

Revoke Privileges Manager Host Component C2

Grant Privileges Manager Host Component C

Merge (Manager Host Component D1, Manager Host Component D2)

Revoke Privileges Manager Host Component D1

Revoke Privileges Manager Host Component D2

Grant Privileges Manager Host Component D

Merge (Manager Host Component E1, Manager Host Component E2)

Revoke Privileges Manager Host Component E1

Revoke Privileges Manager Host Component E2

Grant Privileges Manager Host Component E

Merge (Manager Host Component F1, Manager Host Component F2)

Revoke Privileges Manager Host Component F1

Revoke Privileges Manager Host Component F2

Grant Privileges Manager Host Component F

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As mentioned, when two organizations use our architecture they can merge together easily, follow these steps:

First step: merge data center of both organizations.

Second step: Systems that are common in both organizations should be integrated with each other and made a single system.

Third step: Systems that are uncommon in both organizations should be connecting to data center. Fig11

Fourth step: Any of systems can connect and communicate to other systems with using two hands plug in interface and service interface (fig.12) in a way that they can send/ receive data

Fifth step: Management systems that are common in both organization and management must be removed and a single management stays on aggregate systems.

Sixth step: Management systems that are uncommon in both organizations will be defined as new management in the new data center.

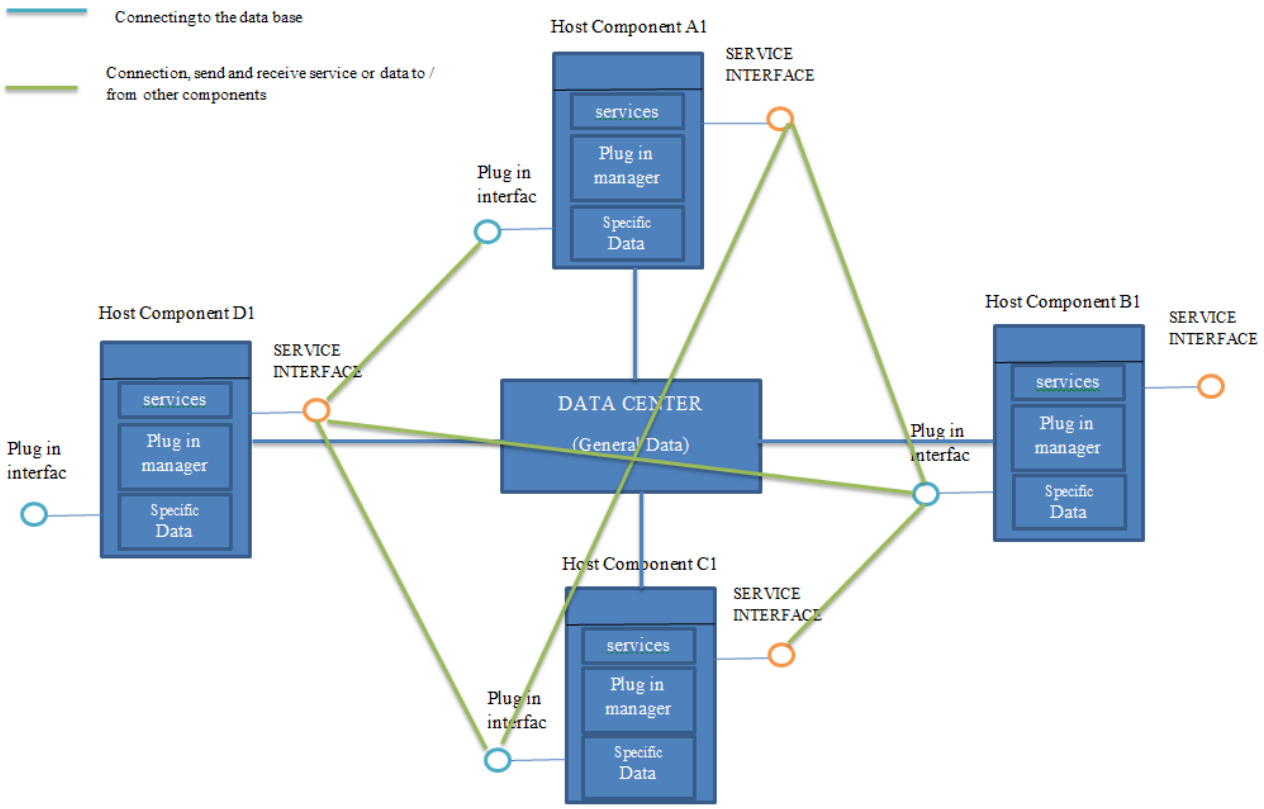

Figure 7. First organization's systems and their relations.

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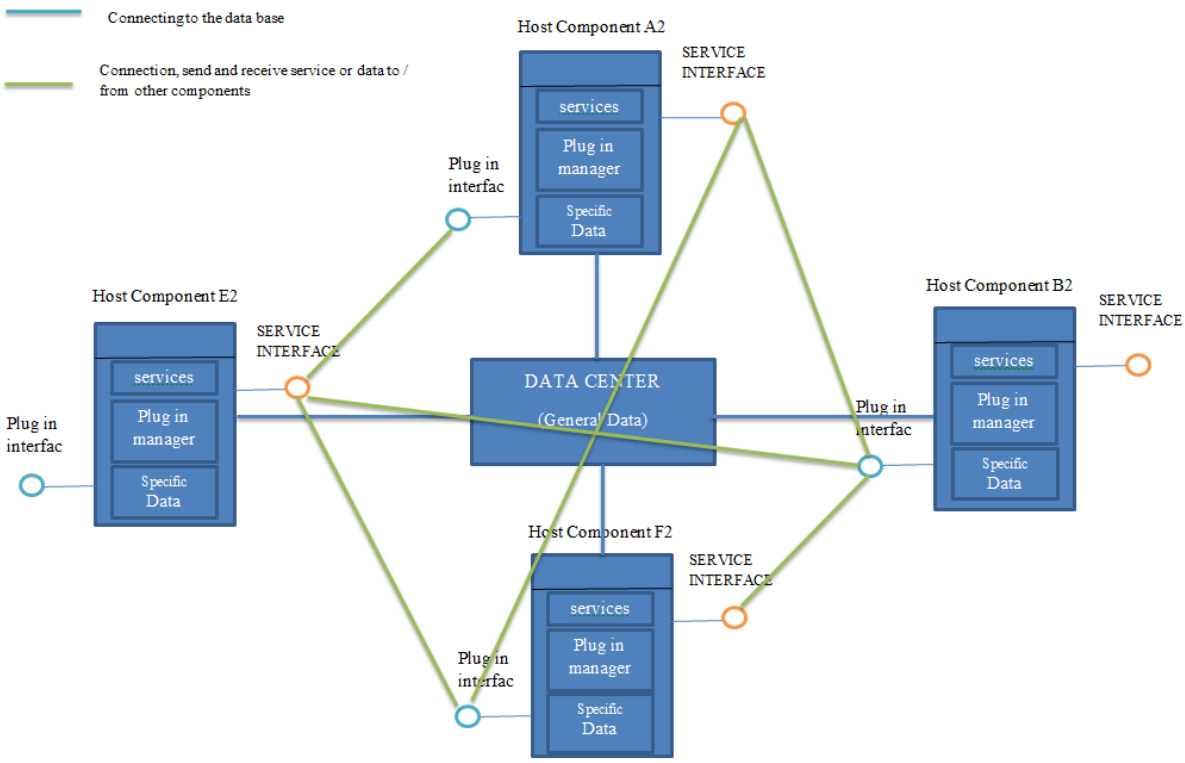

Figure 8: Second organization's systems and their relations.

First step: merge data center organizations.

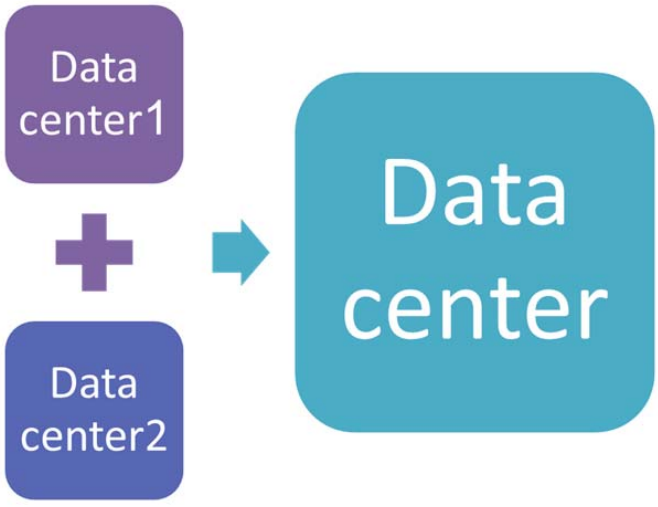

Figure 9. Merging both of the organization's data center.

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Second step: Systems that are common in both organizations should be integrated with each other and made a single system.

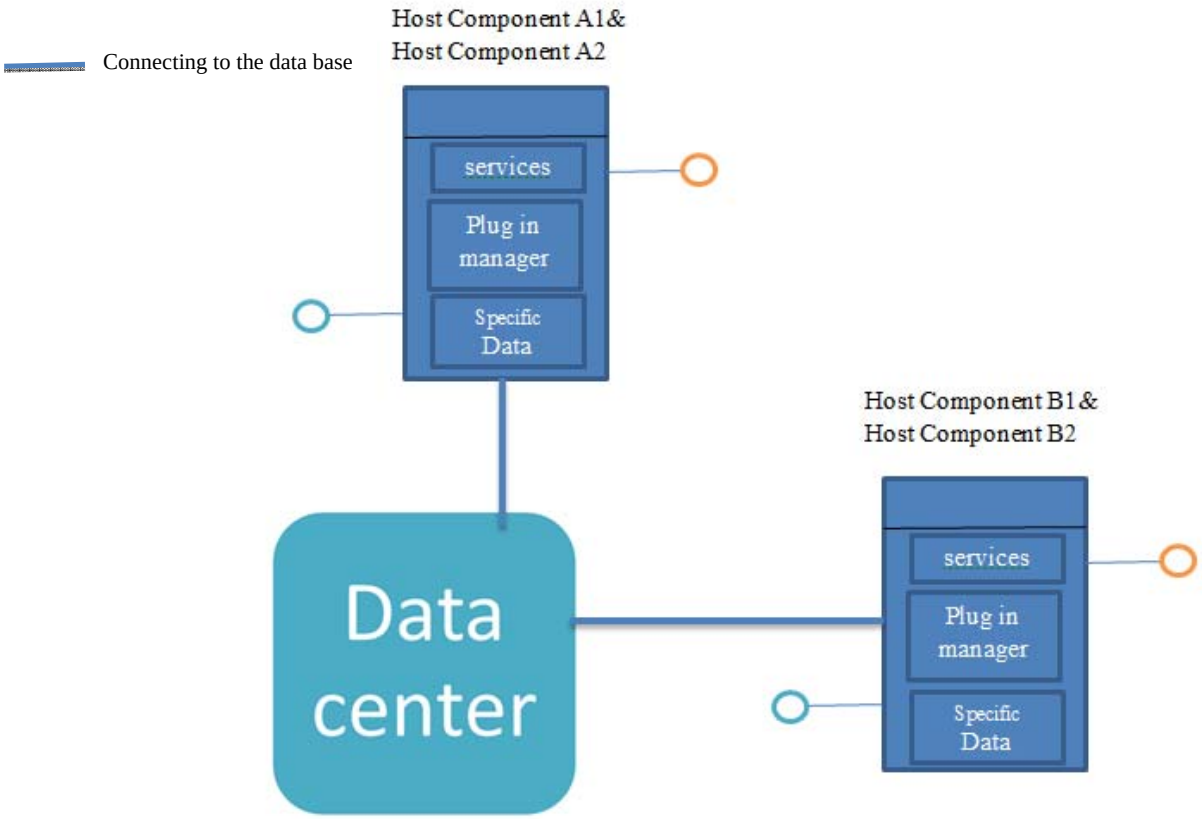

Figure 10. Merging common Systems of both organizations and connecting them to the new data center.

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Third step: Systems that are uncommon in both organizations should be connecting to data center.

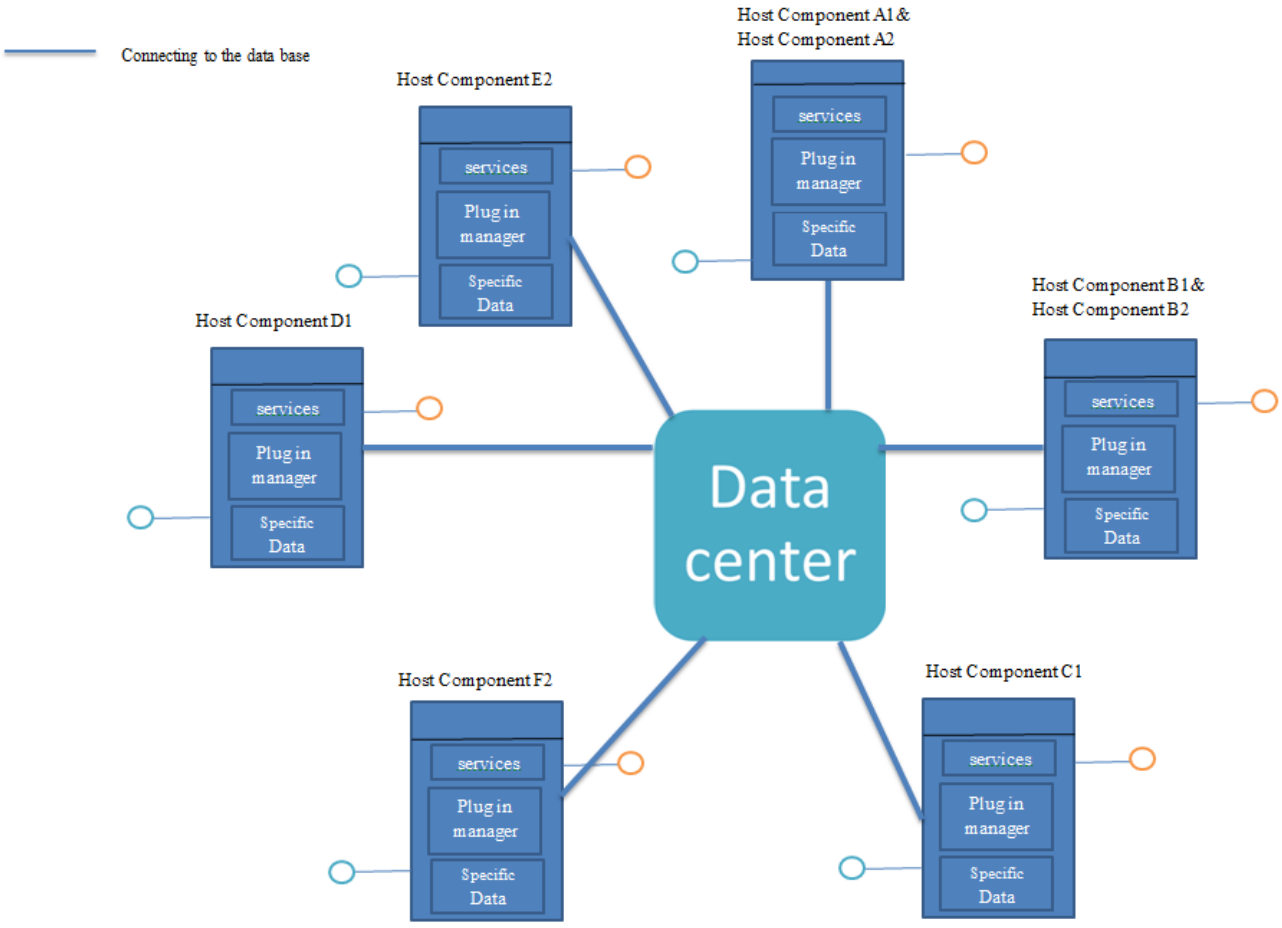

Figure 11. Connecting the uncommon systems to the new data center.

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Fourth step: Any of systems can connect and communicate to other systems with using two hands plug in interface and service interface (fig.12) in a way that they can send/ receive data

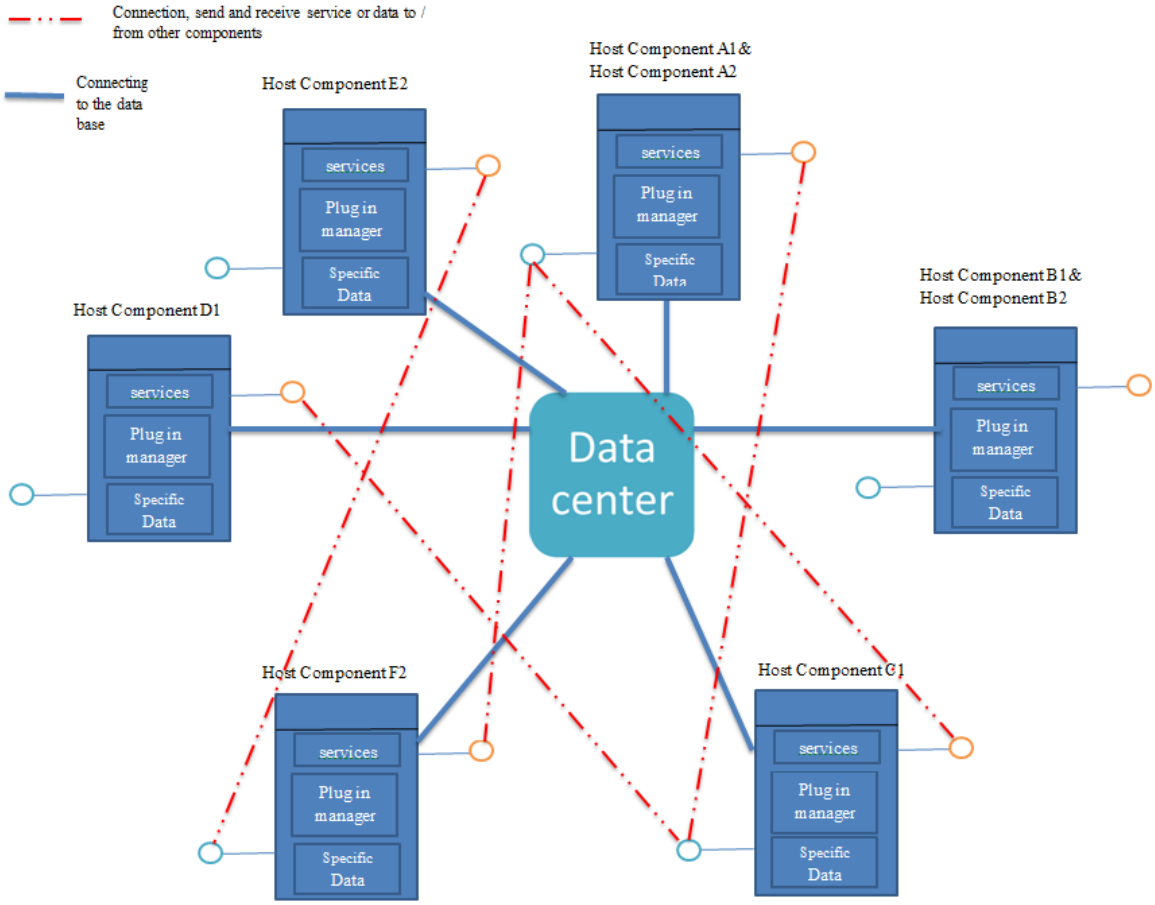

Figure 12. The integration of the two organizations.

Algorithm Merge (ORG1, ORG2)

Input: subsystems and all the relationships in org1 and subsystems and all the relationships in org2

Output: A new integrate system

1. Org1 ⟵ organization 1;
2. Org2 ⟵ organization 2;
3. Data Center ⟵ marge (DataCenter1, Data Center2) ;
4. Data Center ⟵ all public data in data center1;
5. Data Center ⟵ all public data in data center2;
6. For all Host Component i ∈ Org1 and Org2
7. Delete i relations with data center 1 or data center 2;
8. Revoke Privileges Manager Host Component I;
9. End for.
10. For common subsystems in the org1 and org2
11. Do merge common subsystems;

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```
12.          Add i relations with data center;
13.          Merge specific data of common subsystems of org1 and org2;
14.          Merge services of common subsystems of org1 and org2;
15.          Grant Privileges Manager Host Component I;
16.             End for.
17.  For uncommon subsystems in the org1 or org2
18.                   Add i relations with data center;
19.                   Grant Privileges Manager Host Component I;
20.             End for.
21.  If subsystem i need to connect with subsystem j;
22.                   Add relation between plug in interface i and service interface j;
23.        End if
24.  End.
```

Now that the problem development of the system and merging of the two organizations systems was resolved with the proposed model, systems can transfer data between the old and new systems, the second Problem of imprisonment or trapped data will solved by using the proposed architecture. With attention to development of system the third problem programmer locked-in problem, the only programmer can develop the system further will disappear.

XI. Conclusion

According to studies, each of architectures has problems. In plug in architecture database is not appropriate place to store information, component architecture is week in data integration, components will connect to gather hardly and in datacenter architecture there is no link between systems and all systems are connected to database, finally with the proposed architecture 'CPDC Architecture' which is a special combine of three architecture not only solve all above problems but also Take advantages of them to Resolving problems like: developing new systems, merging common systems of different organization, imprisonment or trapped data, programmer locked-in problem, the only programmer can develop the system further. The architecture responds to the issues, ensures scalability and versatility of the systems of organization and eventually ensures the integrity between all systems.

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High Performance Algorithm Development For Inventive Micro-Patch Anti-Aliasing Interpolation Technique For Digital Camera API

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***Abstract* -The standard approach is usually to determine the actual target value as well as discover the hest-focused image location by means of ascending lookup approach. Due to the fact auto-focus algorithm need to be real-time, the standard auto-focus algorithm may have several issues because of growing calculations as number of window region position may vary frequently. A distinct issue will be the frequent interpolation of auto-focus gets slowed because of growing computations. Furthermore, the likelihood associated with de-focusing of target picture may possibly rise as a result of mismatch of the algorithm execution and output of focus. Local-aliasing-sampling approach is apparently utilized to cut back the calculation particularly in HD-dig-cam. Nevertheless, within the Local-aliasing-sampling approach, many precise details may misplace along with raise in noise element. Consequently, the lens deviates through the accurate-position and image blur may occur. To overcome this problem, the recommended technique "micro-patch interpolation" quotes each and every lost pixel through a collection of texture-relevant semi-local pixels while using the consistency likeness recurrently calculated from a series of patches of numerous dimensions. Particularly, using iteration, major texture-relevant pixels are employed to develop an information faithfulness expression in an optimum a posteriori evaluation, along with a bilateral complete deviation is employed as the regularization expression. Experimental outcomes weighed against present interpolation approaches prove that our technique can't merely significantly reduce the aliasing issue but additionally develop much better results all over an array of views equally regarding quantitative analysis along with subjective image quality. The presented algorithm can be further used as an API for digital camera image quality enhancement.**

I. INTRODUCTION

Image Interpolation deals with the issue of getting a high-resolution graphic from its minimal-resolution comparable version. It truly is essential to numerous real-world applications, like biometrics, monitoring, as well as safety measures, in which the image resolution of the taken images are generally really low along with the clear aliasing outcomes frequently seem a result of the constrained volume of charge-coupled-device pixels employed in professional digital camera models [1,2,3]. In line with the Nyquist–Shannon sample theorem in the event the sample rate of recurrence is scaled-down than double the absolute maximum rate of recurrence of HR image, each of the image data preceding half the sample frequency are eliminated [4,5]. Subsequently, the MR image is damaged by means of aliasing see Figure-1(a).

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Figure-1: Observed experimental image "flower-head" (a) Original MR image. (b) Interpolation method. (c) Micro-patch Interpolation Algorithmic method output.

Widely used linear interpolation approaches like the bi-cubic approach accomplish interpolation in line with the homogeneous presumption and therefore are unable of aligning to different image structures, frequently generating blurry edges [6]. This particular inspires numerous scene-adaptive image interpolation techniques of which attempt to discover predominant image structures along with edge details of the graphic. We focused over the window positioning technique to moderate the interpolated image size-window and also the pixel positioning involving the images border multiple windows and applied this to execute the interpolation of mismatched window edges from the weighted mixture of nearby pixels of the image.

Ridgway, John P. (2015) suggested interpolating the lost pixels along a number of directions initial after which merge all of them by reducing mean square error [7]. Jiang, Xudong, et al. (2015) approximated the mismatched window edges by using a 2-D design, and that is realized through the regional neighborhood edges of the image [8]. Commonly, such techniques can operate efficiently in the case the window border of image are appropriately approximated.

Nevertheless, for noticed MR image together with aliasing artifacts, these kinds of techniques are not able to retrieve ground-truth information effectively. Refer Figures 1(b) & (c), and may even typically interpolate over fitting artifacts, especially at good textures. In addition, we attempted to accomplish image super resolution applying instruction data source of MR and HR patch sets. Even so, considering that these kinds of techniques derive from the best presumption there are hardly any aliasing artifacts in MR images, they still are not able to successfully deal with aliasing issues.

Normal images typically comprise numerous repetitive equivalent sections, perhaps inside a one image; hence, without effort, sections of damaged noticed graphics could be refurbished through a collection of equivalent individuals. This kind of remark has become extensively followed in certain programs like image recovery and de-noising [9]. As an illustration, in the event the border position pixels of 2 pictures have been in identical size, this implies that change of previous lens placement could hardly enhance the target quality considerably, which suggests the positioning of lens is actually far from the targeted region, and also the subsequent relocating step sizing must be, improved [10]. Encouraged by nonlocal means, enhancements additionally contemplate recurrently growing a nearby dimensions and making use of numerous neighborhood dimensions intended for de-noising. The

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accomplishment of those techniques completely is based upon the remark that presently there occur repetitive equivalent areas in a individual graphic.

As we understand, the structure of tool display techniques will definitely cost huge amounts of investment capital of digital products producers; nevertheless, the design is still a protracted progress routine. Consequently, it really is enormously considerable to make use of digital image technologies within the earlier stage of tool design [11], that may enhance the layout level, reduce the expense as well as lessen the particular cycle. Depending on this particular fundamental notion, we suggest to get better every single lost pixel using anti-aliasing through a collection of texture-relevant MR pixels inside the neighborhood, as their pixel-focused sections act like the related area focused because of the lost pixel. In comparison with the nonlocal notion, locating the identical sections inside a neighborhood considerably lessens the computational intricacy, and this kind of approaches is often known as semi-local techniques [12].

Especially, we suggest a recurring multi-scale interpolation approach to approximate every single absent pixel through a collection of texture-relevant semi-local pixels, in which the consistency likeness is calculated through huge to smaller area dimensions recurrently. The likeness dimension with huge area dimensions can minimize the effect of aliasing artifacts from the image; in contrast to the measurement along with modest area dimensions can prevent over fitting outcomes for good as well as thick textures. To help promote improved effectiveness, the results of earlier iterations are gathered jointly as inputs to the future scaled-down level interpolation: This tends to not merely inherit the benefits of applying large-scale sections but additionally filter erroneous outcomes of preceding results and progressively restore the better specifics. In each and every version, leading texture-relevant semi-local pixels are determined to develop facts faithfulness expression in an optimum a posteriori appraisal, along with a bilateral complete deviation is employed as the regularization expression. Experimental outcomes balanced with present interpolation approaches authenticate that our technique can certainly minimize aliasing artifacts considerably, and simultaneously, additionally, it outperforms some other approaches equally regarding quantitative assessment as well as subjective graphic quality.

Within section II the basic idea for numerous approaches of anti-aliasing are presented. Section III gives supporting framework for camera focus precision technique; In section VI gives the micro-patch interpolation method details. Section V describes proposed recurring micro-patch interpolation method. Section VI is the representation of experimental outcome and comparison with existing method. Conclusions are drawn in Section VII.

II. KEY RESEARCH BACKGROUND

Although the majority of the preceding approaches perform by means of immediately reducing pixel-to-pixel dissimilarities, an alternative category of algorithms sticks to removing a sparse group of characteristics after which coordinating most of these together [13]. Feature-based solutions have the benefit of getting better quality towards picture movements and therefore are perhaps quicker, if executed properly. Their most significant benefit, even so, is usually to be able to “recognize panoramas”, i. e., to instantly obtain the adjacency (overlap) associations between the unordered group of graphics, making all of them preferably fitted to completely automatic stitching of panoramas considered by informal end users [14]. A range of these kinds of parametric movements types are

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feasible, through straightforward second transforms, to planar point of view types, 3 dimensional digicam shifts, lens distortions, along with the mapping the chance to non-planar (e. g., cylindrical) areas [15].

1) Gradient area alteration: Regarding the usage of photograph improvement, investigator employed the gradient area alteration to approximate the particular pointed gradient area, where the sharpness mapping purpose through the fuzzy graphic towards the pointed graphic need to be provided. Next the pointed graphic could be restored through the altered gradient area. We outlined a couple of approaches to discover the sharpness mapping functionality. Primary, a parametric sharpness mapping functionality is made for improving this sharpness of fuzzy graphic, where an individual parameter is liberal to be tuned through the end user. Subsequent, sharpness exchange mapping functionality is created by switching the particular sharpness syndication of any provided pointed graphic or even normal graphics towards the fuzzy graphic [16]-[19].

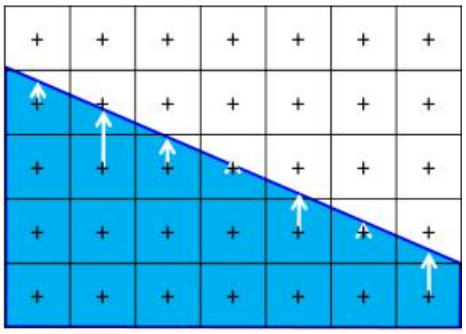

Figure-2: Utilization of edge pixels to configure the geometric edge [15].

The interpolation dependent method approximates the particular high-resolution graphic by interpolating the actual unfamiliar pixels using the adjoining recognized pixels. This specific choice does not solve sub-window-pixels problems; due to the fact simply less samples are usually acquired. Other problems untreatable via this process tend to be interpenetrations as well as problems when sides aren't even length, such as dark areas in addition to available textures. [20]–[21].

2) Hue Saturation Intensity (HSI) Technique: There is certainly considerably less function in the region of individual graphic blur evaluation employing non-parametric kernels. The effort by Shen et al. (2015) is in all likelihood the most known approach to this kind [16]. Shen et al. employ normal graphic data to discover a graphic before that is certainly employed in a variance Bayes method. A new method of color image segmentation is proposed. It is based on the K-means algorithm in HSI color space and has the advantage over those based on the RGB space. Both the hue and the intensity components are fully utilized. In the process of hue clustering, the special cyclic property of the hue component is taken into consideration. [15].

3) G-Buffer Method: [17]-[21], right here concentrate on effectively covering scenes having numerous distinctive geometric components causing the look of a individual pixel, within the framework of real-time deferred manifestation techniques. The particular key concept of the approach is to decouple the rate from which lighting effects is tested, which in turn we would like to retain as little as achievable, through the testing rate of geometry along with resources. The actual aim is to conduct this specific decoupling even though keeping the look of higher consistency information within the graphic. Maintaining a high steady frame rate is an important aspect in

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interactive real-time graphics. It is mainly influenced by the number of objects and the number of lights to be processed for a 3d scene. The upper-bound effort for rendering a scene is then defined by the number of objects times the number of lights [16]. This kind of objective is accomplished through motivation by surface-based pre-blocking as well as preprocessing-filtering approaches. In this particular method the latest deferred covering pipeline is established which in turn dynamically creates and also shades small per-pixel aggregates of statistically explained characteristics, as an alternative to samples through specific scene areas. It compactly encodes the syndication of absolute depths along with covering portions essential for covering.

Keeping all above mentioned approaches as a baseline for further research, we presented new framework of anti-aliasing approach in subsequent section-III.

III. FRAMEWORK OF ANTI-ALIASING TECHNIQUE

There are numerous step-down sampling operations which could possibly produce a discovered graphic. In this particular paper, to pay attention to the aliasing issue, we believe that the graphic is produced by primary step-down sampling through the sub-window patch graphic preprocessing.

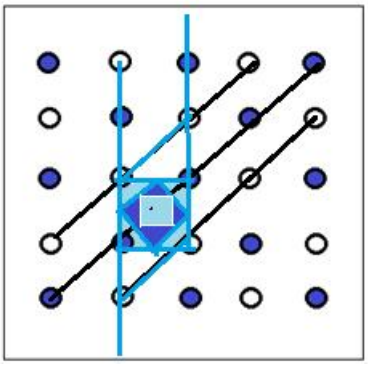

Figure-3: Step-down-sampling approach by sub-window camera focuses dimension calculation. (Source: Self algorithmic representation)

Image is presumed for being immediately lower sampled through sub-window resizing. Graphic is shown in Figure-3. Following step-down-window-resizing sampling, aliasing artifacts look in the region of higher frequencies, the location where the content as well as sides are altered in contrast to the bottom fact, as demonstrated in Figure-4(a). Between nearby covering pixels, covering must also be strained so as to be the cause of dissimilarities of focus in a provided combination. This can be accomplished in addition to the preliminary volume of samples integrated inside each and every combination. The concept is always to sample in the shadow-map within the form of the combination, which in turn we statistically described through the mean as well as deviation from the detail value. In practice, we rebuild the world-space 3 dimensional location along with deviation vector, and also project all of them in the shadow map in order to sample in this particular presence employing a predetermined volume of samples. As per Figure-4(b), the significance of hidden pixel can be approximated by using position of pixel x_{α} where the region of correlation can be obtained by means of x_{α}. According to this, we can easily attempt to interpolate the lost pixels using anti-aliasing through a collection of texture-relevant semi-local pixels. That is certainly, we attempt to

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recuperate each and every lost pixel y_i dependant on a collection of pixels x_i the location where the textures with the neighborhood sections focused by means of x_i are usually equivalent or even strongly related of which with the neighborhood area focused by y_i [14]. Considering that almost all pixels y_i are lost, preliminary interpolation $\bar{I}_s$ is necessary to commence this procedure. Within the best although impracticable presumption that $\bar{I}_s$ is equivalent to reference-ground truth factor I_s, each and every lost pixel y_i is usually loaded by their nearly all identical pixel x_i. Even so, getting extremely precise preliminary interpolation through the start is challenging. Alternatively, we employ window resizing interpolation as preliminary interpolation since it can retrieve the lost section of minimal frequencies effectively. However, the particular aliasing artifacts taken place in the region of higher frequencies even now continue to be. As highlighted in Figure-4(c), the interpolated importance at pixel $y_b$enormously deviates through the ground fact.

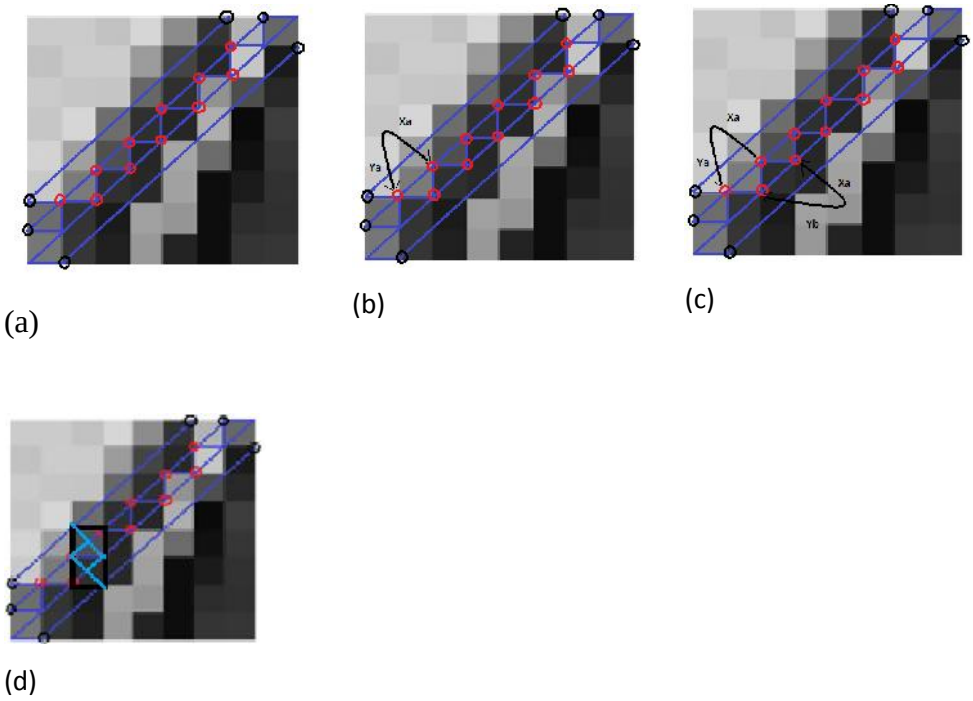

Figure-4: Step by step workout of anti-aliasing approach. (Source: figure(4d)Self Algorithm Representation)

To mutually deal with the aliasing issue along with the inaccuracy of preliminary interpolation $\bar{I}_s$, we suggest a recurring micro-patch interpolation technique which explores texture-relevant sub-window pixels within a recurring multi-scale approach. This technique features couple of key concepts like:

Pixel focused diagonal coordinating - For each and every lost pixel, nearby pixels inside a area focused through the present lost pixel can be employed for the reason that reference to discover texture-relevant pixels. Considering that easiest graphics come with a significantly decaying power array, the aliasing artifacts merely can be found in a little portion of pixels in high-frequency regions. Furthermore, many graphic pixels in low-frequency regions are usually

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interpolated effectively by means of preliminary bi-cubic interpolation. Direct line portion is amongst the most elementary chart in a rectangular border graphic. The technology effectiveness as well as image quality of direct line portions should have immediate impression altogether graphic mapping. Since diagonally moved lines will be as near as individual pixel mapping series. This can be visible in Figure-4(c), the reference-pixel can be connected by other free pixel, this region outlines the target focus and focus-importance is calculated using a region covered by pixel-focused area. Figure-4(d) shows the diagonal line shifts with smaller pixel shifts and shadowing to get most precise focus point on image.

Recurring micro-patch interpolation is suitable to choose bigger area dimensions to ensure that much more curve-covered pixels can be used to fit the window focus of camera lens. Alternatively, cut-off window need the scaled-down area dimensions in order to avoid mismatching. Nonetheless, it truly is challenging to look for the acceptable area dimension through the noticed graphic having aliasing. Consequently, a recurring multi-scale interpolation process is offered to assimilate positive aspects via both large- along with small-scale area complementing.

IV. MICRO-PATCH INTERPOLATION WITH PROGRESSIVE ITERATION

In line with the remark in which normal graphic features repetitive equivalent areas along with the evaluation of anti-aliasing in previous section, we offer a recurring micro-patch interpolation technique of anti-aliasing as well as retrieving high-quality graphic. Right here, we will bring in micro-patch interpolation of merely an individual iteration along with individual area size. Within the subsequent, we will first explain how one can evaluate area likeness, accompanied by the patch evaluation for lost pixel value computation.

As stated, the aliasing artifacts even now remain in the in the beginning interpolated graphic I_s. The process is to discover trusted texture-relevant pixels for every single lost pixel y_j by pixel-focused area corresponding within the grid. In this paper, so as to minimize the effect of originally erroneous interpolation, we prolong the nl^2 range as well as recommend a Window nl^2 length. Within the l^2 length, we bring in window M in support of estimate the ml^2 length relating to the pixels in area $u(y_j)$ along with the equivalent pixels in area $a(x_j)$, exactly where a symbolizes pixel-centered area operator within the grid. Window M is dependent upon area $a(y_j)$ and also understood to be follows:

$$M_o = \begin{cases} 1, & a(y_i) \in I_t \\ 0, & otherwise \end{cases} \quad \text{.. (1)}$$

$$M_n = \begin{cases} t, & a(y_n) \in I_n \\ 1, & n(y_n) \in I_n \end{cases} \quad \text{.. (2)}$$

Here q signifies the location of pixel in window M. While considering area $a(y_j)$ which is the located target nl^2, the window M is referenced as outer main focus. Or else, the window M is determined as sub-window with next focus. This action will be recurrent to identify the smallest focus region n which will be treated as $n(y_n)$ with

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unknown value of I_n. After confirming focus for window M, the curve covered region is deducted from window area and remaining semi-local region pixel x_i is determined as follows:

Consider Standard deviation I_t * (Sd) σ_k. Similarly σ_s is the referenced standard deviation for $\omega(x_i y_i)$. Δy_i is the difference between window covered area and covered curve. And Δy_n is the minimum focus pixels calculated at the end of iterative computation.

For each and every deducted region pixel. Δy_i is often as big as the complete graphic and Δy_n as small as the possible focus pixel values; this may discover almost all feasible suitable pixels. In practice, in view of time intricacy, we limit the lookup area within the semi-local area. In line with the experimental outcomes, we established the lookup window and sub-window which calculated around the grid.

σ_k is the diagonal length relating to the middle pixel along with other pixels inside an area whenever carrying out area matching [12]. We applied σ_k as the linear function of the area dimension. Essentially, the spatially nearer pixels are definitely more reliant, along with the pixels nearer to the middle pixel must have much larger weights. Additionally, as eventually explained, we will certainly analyze window and sub-window with multi-scale area dimensions. To be able to provide complete participation of the multi-scale, we established the linear function for the targeted area. Standard deviation refines the impact of window and sub-window distance with ultimate enveloping area as shown in figure-4(d). For every single lost pixel function as a tolerance value to tell apart the texture-relevant pixels through all of the nearby pixels. Generally, at the beginning, interpolated values of lost pixels are erroneous all of which will deliver the dysfunction in to the computation of the window dimension. In the interest of evaluation, we presume the distinction involving the initially interpolated value of sub-window as well as the main window-value to observe a precision of camera focus using the mean zero as well as standard variance.

Now, we can easily observe that window area $M \circledcirc a(y_i)$ is employed for the reason that common area, in addition to the preliminary interpolation till $M \circledcirc n(y_n)$. All interpolated semi-local Window areas $M \circledcirc a(x_i)$ and sub-window area $M \circledcirc n(y_n)$ tend to be balanced with the standard area. As explained later on in this multi-scale method, to include the benefits of each big as well as small-scale semi-local interpolation, we team-up the results coming from all preceding iterations jointly as inputs for that subsequent scaled-down size iteration. The interpolated values of lost pixels one of several inputs is wide and varied. Window area consists of simply pixels and is particularly constant; consequently, sub-window area can be employed as the standard area to equate to all nearby main window areas regardless of what input they're through.

V. RECURRING MULTI-SCALE MICRO-PATCH INTERPOLATION

Through the anti-aliasing point of view, it is suitable to choose bigger area dimensions in an attempt to discover much more trusted pixels. The bigger the area dimension, greater nearby pixels are employed as the reference to locate reference-ground-truth texture-relevant pixels and additional minimize the impact of aliasing artifacts. However, the good textures within the normal graphic need scaled-down area dimensions to get better vibrant compacted particulars. In any other case, the artifacts can look attributable to area mismatching. Nevertheless, it can

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be challenging to look for the acceptable area dimension in line with the noticed graphic having aliasing. In this particular paper, contemplating the two of these complete opposite objects, we recommend an recurring multi-scale interpolation treatment that replicate the semi-local interpolation from large to smaller area dimension recurrently.

Algorithm 1: Recurring Micro-Patch Interpolation

Input: Real time camera image

Step-1. Initializing boundaries of window:

(a) Initial area of focus $F_a = 0$, Initial coordinates of window

$W_c = (0,0)$ i.e. start point of diagonal length of focus window

(b) Set step size as per standard deviation σ_k and area $a(y_k)$

(c) Set σ_s as the referenced standard deviation for $\omega(x_i y_i)$

(d) Record boundaries by matching pixel coordinates of final window focus

(e)Store values of first window focus as a reference window focus area

Step-2. Iterative approximation of diagonal matrix:

(a) Record curve covering coordinates of parallel lines of diagonal

length (refer figure-4(c))

(b) Deduct window focus area from curve covering

extra boundary pixels

(c) Resize window focus to remaining curve

If $WcF_a <$ curve area

go to step-1

else

Consider next curve for pixel coordination

3. Compute diagonal coordinates of focus window

and locate boundary pixels.

4. Remove unfitted curve pixels.

5. Map next curve within diagonal pixel points within window Wcx_i and also Wcy_i.

It ought to be mentioned that this results coming from all preceding iterations tend to be collected jointly as inputs to the subsequent small size iteration, which can be completely different from classic recurring process. In every single iteration, presented the area dimension along with inputs of which included the results coming from all preceding iterations, every single interpolated semi-local window area focused by pixel $x_i \ldots \ldots x_m$, regardless of what input these are coming from, is weighed against lost pixel $y_i \ldots \ldots y_m$ focused area.

Mentioned previously, sub-window area developed by diagonal envelopes provides the pixels merely and is particularly constant, it operates as a common to evaluate the consistency importance of nearby pixels coming from each of the inputs. Additionally, essentially the most texture-relevant pixels positioned at various positions from the

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graphic tend to be determined. At the same time, the inconsequential kinds are filtered out. Subsequently, the patch appraisal, mentioned previously, is utilized to get better the image of present iteration. As iteration increases, the volume of inputs increases. However, the region dimensions which often measure the reliability significance will decrease. This cannot simply confidence how the robustness of anti-aliasing by means of large-scale semi-local interpolation is inherited and also gradually retrieves the compressed and also good textures.

VI. EXPERIMENT: RESULT AND ANALYSIS

Right here, we initially execute experiments of our technique together with several types of regularizes in an attempt to vindicate the requirement of implementing the bi-lateral regularization. Subsequently, we examine the suggested technique with current interpolation strategies on artificial pictures which have been down-sampled from equivalent pictures with elements two and four to rationalize the features of the recommended approach in reducing aliasing consequences. Eventually, we evaluate the suggested approach with present interpolation approaches on real-world graphics to verify the potency of the suggested technique about the graphics which has a more complex lower sampling procedure.

Within the primary research, we implement our algorithm using Micro-Patching regularization towards the artificial graphics, respectively. The experimental results are proven in Figure-1(c) which demonstrates a nearby region of the graphic right after interpolation, which includes extreme aliasing artifacts. This indicates a result of our algorithm "Micro-Patching regularization". We can easily observe that the form of the graphic design is restored properly; however the edges are blurry, as well as the pixels be noticed from the interpolated pixels. The reason being the Micro-Patching regularization causes the spatial smoothness, and this also blurring gathers up inside our multi-scale treatment. Refer table-1 for comparison of Micro-Patching Regularization Algorithm efficiency with Existing Bi-cubic method [6].

Image	Focus-resizing Method		Our Micro-Patch Algorithm	
	Min	Diff	Min	Diff
Flower-head	32.56	0.822	33.71	0.859

Table-1: Comparison of Micro-Patching Regularization Algorithm Efficiency with Existing Method.

Subsequently, the pixels are noticeable contrary to the blurry interpolated kinds. Figure-1(b) exhibits a result of our technique having micro-patch regularization. The apparent structures along with sharpened sides state the main benefit of our approach using bilateral regularization. Figure-1(c) indicates the reference-ground-truth graphic. In this experiment, we evaluate the functionality of the micro-patch regularization algorithm suggested in this particular paper. We tested image captured by digital camera of Mi- model.

VII. CONCLUSION

In this particular paper, we have suggested a recurring micro-patch regularization semi-local interpolation approach to retrieve high-quality graphics through texture-relevant pixels. This process cannot just retrieve high-quality edges along with structures within the graphic but additionally reduce aliasing artifacts of graphics considerably. Experimental outcomes verify the potency of our recommended approach. Also regarding future work, it might be suitable to possess a method of correctly strengthening the computational effectiveness in our algorithm in an

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attempt to encompass much bigger lookup area pertaining to anti-aliasing. And compatible software API can be developed to utilize for real time camera focus enhancement.

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Amalgamation of the Information Security Management System with Business – paradigm shift

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***Abstract*- In today's era of a global knowledge-driven economy, ever-changing enterprise risk, cross-organizational functions and the emergence of mobile services, information is a critical asset to an organization's ability to not only survive, but also to thrive, resulting with information security as a business enabler not solely an information technology discipline. The challenge is to develop & establish an information security program (a governance framework that describes what an effective information security encompasses, how it behaves, and how it relates to the enterprise and its priorities) and integrating it into business goals, objectives, strategies, and activities. Currently, many enterprises create the policies, procedures, processes, technology strategies, and fail to develop & support a holistic and dynamic approach of information security that is both predictive & proactive (not reactive) as it adapts to change considering the organizational culture and delivering value to the business [1]. This paper describes a governance structure for your organization that provides – context, ownership, support & prioritization to establish & implement a holistic approach/framework to understand the interactions and consequences of information risk & how it relates to overall enterprise risk considering interactions of systems, possible root causes and the best solutions to the problem. It also suggests a feedback mechanism to the current posture of the information security management system at an enterprise level for continual improvement.**

INTRODUCTION

As shown in Fig. 1, Global enterprise ecosystems traditional boundaries have been shifted, organizations operate in a dynamic environment that is increasingly interconnected, integrated and interdependent. This ecosystem is built around a model of open collaboration and trust & constant information flow in an enterprise – these are the very attributes being exploited by the adversaries who are actively targeting critical information [2]. Businesses are becoming more globalized and expanding e-commerce abilities which further increase third party dependencies for business operations to maintain effectiveness. The information security challenge now extends beyond information technology and information security must keep pace which requires dynamic relationships internally as well externally. The enterprise needs to have a structured program in place to protect their information; a comprehensive program is needed to address the plethora of compliance requirements and to protect consumer's information & sensitive company information governance resulting in more & more organization's adoption of an information security management system. The ISO/IEC 27001:2013 – information security management system is a liaison between the information systems and business. It gives an end to end model to address business information governance, risk assessment, incident management, monitoring & auditing, processes & controls, technical security controls & training and awareness.

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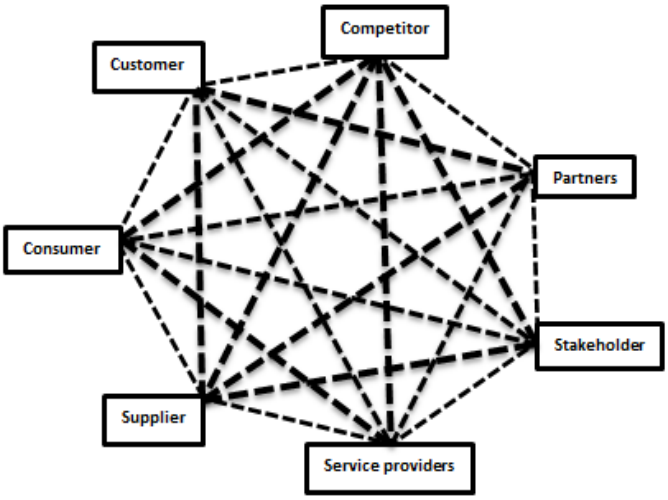

Figure 1. Global Enterprise Ecosystem

We can reap the benefits from the implementation of an information security management system as it is –

1) Comprehensive, organized and risk profile based information security management approach to improve the posture of information security at an enterprise level.
2) Exhibit authority and confidence to all customers & stakeholders.
3) Give a competitive edge in the market.
4) Expand the information security management culture within the organization and grow awareness of all parties.
5) Reduce cost by addressing the correct root cause of frequent incidents.

However, there are a few challenges which we face while implementing an information security management system at an enterprise level, like –

1) Employees are the weakest link of information security management, engaging the non-technical staff in information security awareness & training with the right level of competence and expertise is fundamental to success. In small to medium enterprises, there is an absence of dedicated employees to perform formal training for Information Security Management System which may contribute to this, however, big enterprises have these dedicated employees and external help & advice that manage to implement.
2) Influencing the C-level executives in understanding the requirements of the standard for implementation of an information security management system is another area of challenge. The reason behind this includes sufficient budget allowance, gaining permission to employ sufficient resources and having leadership commitment to complete certification. The implementation of Information Security Management System needs to be business driven not IT driven.

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3) Information assurance & cyber security – the two dynamic aspects of information security & the ever changing business risk profile, make risk assessment & implementing the required controls challenging.

LITERATURE REVIEW

In today's era, information governance & cyber security are challenges for organizations of all types & sizes. The even more difficult question is, to understand & implement the best approach to address both the problems. A sensible & successful approach which is already currently embraced by many organizations across the world is to use internally accepted standards for help & direction. If you comprehend management standard - ISO 27001/27002, information security management systems – requirements & code of practice, you will be able to figure out that the execution of an information security management system is a great starting point for managing the information assurance, cyber security & privacy of customer data. Not only is the adoption of Information Security Management System a strategic decision for an organization, it also provides you the skeleton for other standards like Payment Card Industry Data Security Standard (PCI-DSS), and make it easy to integrate with other management systems like ISO 31000 (Risk Management), ISO 20000 (IT Service Management) etc. ensuring an effective approach to corporate governance. Few key questions / standard definitions for more clarity –

Governance of Information Security [1]: the system by which an organization's information security activities are directed & controlled.

Information Security [3]: preservation of confidentiality, integrity, and availability of information.

Information Systems [3]: applications, services, information technology assets, or other information handling components.

Confidentiality [3]: property that information is not made available or disclosed to unauthorized individuals, entities or processes.

Availability [3]: property of being accessible and usable upon demand by an authorized entity.

Integrity [3]: property of accuracy & completeness

Information Security Management Systems [3]: is a systematic approach for establishing, implementing, operating, monitoring, reviewing, maintaining and improving the organization's information security to achieve business objectives.

PROPOSED FRAMEWORK

As depicted in Fig. 2, Enterprise Information Security Management Governance Hut, the proposed framework consists of four main driving factors

A. Base

The base of the information security governance hut is comprised of its three basic actors i.e. people, process & technology. We can't have good governance if any one of them is missing.

B. Strategy

The middle six pillars show the strategies to achieve our goal.

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C. Mindset

The organizational culture shows the influencing factor for the completion of strategies. This is one of the major factors which either drives us or fail us to achieve our goal.

D. Goal

The roof of the governance hut depicts our final accomplishment.

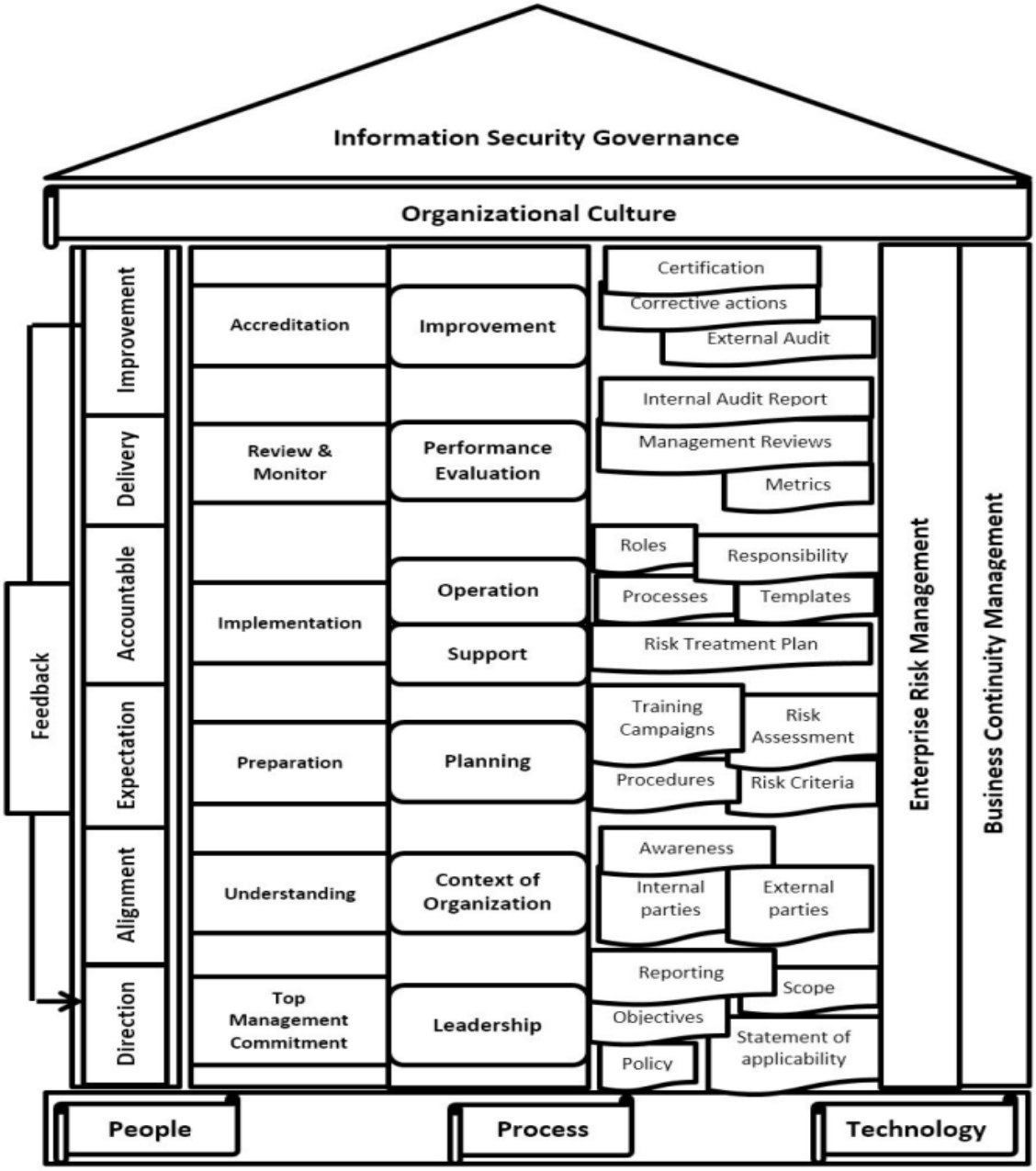

Figure 2. Enterprise Information Security Management Governance Hut

Below is the detailed narration for information security governance at an enterprise level –

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1) The Actors – No doubt any organization's base & success depends on these three actors – people, process & technology. People are the weakest link for information security, the engagement of the people along with the organizational processes & related technology are required. Due to the dynamic nature of actors, we need to make sure they keep pace with the current emerging risk & technological trends. If any of the actors behave static, it will directly lead to the failure of the goal.
2) The six strategic pillars – the six pillars of the hut drives the strategy to achieve the goal. Let's break them down in a detailed manner –

   Pillar one – Building blocks for good governance [4] in any organization.

   Pillar two – ISO 27001 enablers

   Pillar three – ISO 27001[5] implementation steps

   Pillar four – accomplishment of ISO 27001 implementation steps

   Pillar five - for continual improvement enterprise risk management, being proactive, not reactive

   Pillar six – providing resilience to the organization
3) The influencer - one of the biggest mistakes that organizations do while implementing strategic goals, avoids the factor which influences drive i.e. organizational culture. If the organization is not adaptive to change it's a big mistake to introduce strategic governance, it leads to failure. On the other hand, if the organization is flexible and proactive in nature, these initiatives will lead to success and recognition. We shall always consider the organizational way of working before implementing strategic information security governance at an enterprise level.
4) The roof – the final goal of the whole methodology is marrying the good governance practices already in the organization with one of the best security standards to deal with emerging risk & cyber threats. The standard gives a base to develop further security practices in the organization; it also helps in reducing the cost from implementing the two separately and develops a single framework to implement both together.

DETAILED METHODOLOGY

Assuming an organization follows the good governance practices comprised in the below steps, below are the security initiatives suggested to achieve the information security management system scoping at an enterprise level not limited to Information Technology, Human Resources, Legal, Loss Prevention & Facilities.

A. Direction / Top management commitment / Leadership

At a high level, outline the security plan in terms of business initiatives, priorities, and strategic goals. Assimilate the security process into business planning activities. Develop periodic reporting processes to senior management and to the board of executives, identifying risk areas of business and the status of security processes addressing those risks.

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B. Alignment / Understanding / Context of the organization

Build up information security mindfulness and training programs that comprise of senior management. Also, establish an information identification & classification scheme based on the confidentiality, integrity & availability requirements. Define the risk assessment and acceptable risk criteria. Cultivate a comprehensive understanding of all internal and the external interested parties.

C. Expectations / Preparation / Planning

Characterize security prerequisites and create information security policy statements, including an information security principle framework for supporting standards, procedures, guidelines and rules of use. Acquire support from executive management and issue the documents under authority. Furthermore, integrate the information security policy statement into the overall corporate governance program to ensure periodic review and update.

D. Accountable / Implementation / Operations & Support

Establish ownership for information security responsibilities with the departmental managers. Develop a security function that assists management and various departments in formulating the policies, supporting standards, procedures and guidelines and assists the organization for their enforcement. Implement information security policy & principles at an organizational level. Furthermore, establish & enforce security baselines of various information systems and rigorously monitor compliance. Launch an ongoing security awareness campaign consisting of a repetitive and assertive communication plans that reach every employee. Build up a code of conduct / rules of use / confidentiality agreements for information system use.

E. Delivery / Monitor & Review / Performance evaluation

Establish a periodic review program to analyze the current organizational practices against the industry best practices and implement security according to those practices. Create action plans to close any gaps and monitor for completion. Institute a regular communication mechanism from the information security team to the board of executives for ongoing security activities and issues. Also, define an emergency communication mechanism for urgent security escalations & decisions. Perform risk assessments based on the best practices and compare the results with defined organizational risk criteria. Create a process with Human Resources to include a rating of employee security activities in their annual appraisal process.

F. Improvement / Accreditation / Improvement

Finally, ensure that a process of security audits exists, conducted by adequately trained audit staff (internal as well as external).The combined scope of audits covers all critical security areas including the security processes and the way it is managed at least annually. Establish projects to ensure timely follow-up of all audit findings.

G. Enterprise risk management

Establish a risk management framework that ensures all business critical assets are identified, threats and vulnerabilities are evaluated, and appropriate corrective controls are in place to address the associated risks. Develop a comprehensive framework including an ongoing assessment from vulnerability assessments, log monitoring reports from information systems, reports from intrusion/malware detections, testing of contingency plans, release management & patch management frameworks for software development lifecycle etc. Risk assessment should also

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establish a requirement for legal & regulatory needs to be addressed in security policy and procedures. Perform & collate a risk assessment for all new information systems / new infrastructure components and ensure reporting to senior management on a periodic basis.

H. Business Continuity Management

Ascertain a process for business impact analysis for all key information systems / services. Create business continuity plans that enable recovery of information systems or initiate alternate business processes within an agreed time frame. Perform regular testing of business continuity plans to identify weakness and improve response. Ensure that employees are well aware of their responsibilities at the time of crisis and trained as per the plan.

Finally, we need to feedback the learning to senior management before designing the next strategies so that we will incorporate all the gaps for continual improvement. A good governance practice is not a one-time task; it's an iterative method for improvement of any process. It provides the proper direction & structure to manage processes & goals.

CONCLUSION

This paper proposes a framework for development and implementation of information security management system in alignment with the good governance followed in the business to give a new approach and structure to the organization to adapt. The proposed framework gives a comprehensive view of information security at enterprise level and a cost effective & innovative method for continual improvement of processes to improve the overall posture of the organization in terms of information security management.

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Intensity Correction & predicting the high resolution patches for Super Resolution of Medical Images

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Abstract - Medical images are used to find the existence of certain underlying medical conditions. The increase in the resolution of the image helps to substantially improve the diagnostic capabilities of the medical practitioner and paves the way for automatic detection of the disease. Despite the advancement in medical imaging acquisition devices like Computerized Tomography (CT), Magnetic Resonance Imaging (MRI) etc., the problem of Noise, Blur limits the overall ability of these devices to produce higher resolution images. A solution to this problem is the use of Super Resolution (SR) techniques which can be used for processing of such images. Various methods have been described over the years to generate and form algorithms which can be used for building on this concept of Super resolution. This paper initially deals with the Intensity correction of the Medical images and means to enhance the quality and visibility of intensity inhomogeneous medical images. Later on, the paper explains the work currently done in the field of Super Resolution which includes the famous Sparse based reconstruction method, single & dual dictionary methods, Non local Auto regressive Modelling. The latter part of the paper introduces the statistical prediction method and explains the algorithm developed to enhance the resolution of the image over existing technologies.

Keywords **-** Intensity Inhomogeneity, Super Resolution, Patch reconstruction, MRI, Sparse Representation

1. Introduction

Image processing deals with the processing and manipulation of digital images. Image enhancing algorithms and software are incorporated to achieve this image enhancement. This high resolution image is used in various different engineering fields to zoom in on a particular region of interest. The raw data from the image acquisition sensors are processed further and are given to different image processing and enhancement algorithms to help remove the noise element blur components and increase the resolution of the image.

High resolution images are desirable for all our daily applications involving Image processing. With the help of a high resolution image, one can easily increase the accuracy with respect to finding a localized tumor or increase the visual excellence of watching a high definition video. The quality of the sensor generally decides the resolution of the image. But as the quality of the sensor increases, so does the cost of the acquisition device. Therefore a solution needs to be reached to overcome this hardware problem and replace it with a software system which will help to increase the resolution by keeping the hardware same. Such a software system is discussed in this paper and the name of the image processing technique used is called as Super Resolution Reconstruction.

2. The concept of Super Resolution

Super Resolution (SR) or Super Resolution Reconstruction (SRR) methods is basically used to get the High Resolution (HR) image from one or more Low Resolution (LR) input images. Super Resolution (SR) is done either using the single image method wherein one low resolution image is used to obtain the higher resolution image using a dictionary method or is done using the multiple image method wherein multiple low resolution images are used to obtain the final high resolution image. [12]

The basic concept of Super-resolution lies in the idea of combining low resolution and noisy images of a particular region and using these to obtain the higher resolution image.

We resample the high resolution image and produce the low resolution image. To this low resolution image we apply the Super Resolution algorithms which include the steps of Interpolation, noise and blur removal. When these steps are applied to the patch of the sampled LR image, we receive the HR patch. These HR patches later on form the HR image.

The main advantage of the single image based super resolution method is that we do not require many LR images. We use only one LR image and divide these into patches and work on one specific patch to obtain the higher resolution patch. The higher resolution patches are then used to find out the final high resolution images by combining all the higher resolution patches together.

3. Super resolution in medical images

The conventional interpolation techniques are found wanting when the medical image is consisting of intensity inhomogenity, blur and additive noise. Simple techniques like interpolation can only add extra pixels and improve the resolution but not do any task of removal of noise and intensity corrections. Such problems give rise to the new methods of Super Resolution wherein along with image resolution, the quality of the image with respect to noise and blur removal also needs to be considered.

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Medical images are unique for the particular reason that they are taken in an environment which is much more challenging than the normal acquisition atmosphere. Therefore, the problems that accompany the medical images are very much of a higher magnitude when compared to normal images. General problems plaguing the medical images are given as below: [12]

- Low resolution
- Higher magnitude of Noise component
- Images with low contrast
- Imaging artefacts present in the image

4. Intensity correction of medical images

Variations of illumination in the spatial domain and the imperfections of devices that capture the images can lead to many problems in Computer vision and Image processing techniques. The particular cases of Image segmentation may be difficult for images that have intensity inhomogenity due to different ranges of intensity that exist in an inhomogeneous image, thus making it difficult to identify images based on image intensity. Present day algorithms rely on the homogeneity of intensity and therefore images that are inhomogeneous are not applicable for practical purposes. Therefore, the idea of having level intensity homogeneity is very important.

In the paper [6], a novel region-based method for image segmentation is used. This paper makes use of a local intensity clustering property and defines a local area clustering benchmark function for the intensities in a neighbourhood of each point. An accepted model of images with intensity inhomogeneities is used. This local area clustering benchmark is integrated over the intensity centre to define energy functional. This energy function is then converted into a level set formulation. By means of bias field estimation and energy minimization, a level set evolution of intensity is achieved.

Bias correction and segmentation of MRI images can be extensively done with this method. This method is based on a model of an image which describes a combination of real world images which defines intensity inhomogenity to be a part of the image. By using the multiplicative model of intensity inhomogenity, we can observe a given image as a combination of the original image as the first part, the second part that consists of intensity inhomogenity and the third part that consists of additive noise. The component that gives an observation of the pixels that have high intensity is referred to as a *bias field* (or *shading image*). This field we assume to be slowing varying. The additive noise is assumed to be zero-mean Gaussian noise. The image segmentation methods based on region selection typically relies on a specific region description of the intensities in each region to be segmented. But it becomes very difficult to give a descriptor for images which have intensity inhomogeneities. As a result it gets very difficult to segment the inhomogeneous regions directly based on the different intensities of pixels involved in the image.

Here a variation level set criterion for image segmentation and image bias correction with intensity inhomogeneity is used. The twin tasks of Segmentation and bias field exploration is jointly done by reducing the proposed energy functional. This method is much better than piecewise smooth model used earlier. An experimental result on the MRI of a shoulder and MRI image of a brain gives superior results which can be seen in the below figure. Effective Image segmentation and bias estimation of the MRI image occurs and we observe an intensity homogenous image as under.

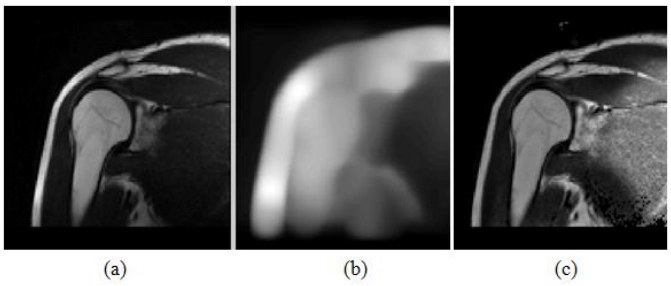

Fig. 1 Intensity Correction MRI image of shoulder: Original image of MRI of shoulder (a), bias field of the image (b) and Intensity corrected image(c)

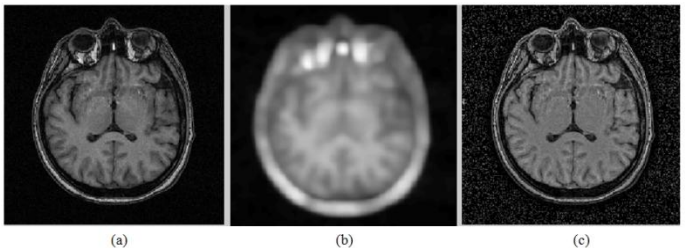

Fig. 2 Intensity Correction MRI image of brain: Original image of MRI of shoulder (a), bias field of the image (b) and Intensity corrected image (c)

5. Existing technologies for super resolution of medical images

Super Resolution in simple terms means that we are recovering the original image which had high resolution by combining together the low resolution images. A reasonable assumption and knowledge about the observational model is required to be followed. The final aim is that the recovered high resolution image obtained after all the processing algorithms should be able to reproduce the same low resolution images too. The main problem with Super Resolution reconstruction is that the number of low resolution images, the unknown blurring functions and the solutions obtained from the reconstruction constraint is not unique. Various techniques to overcome these challenges have been proposed to overcome these issues pertaining to Super resolution.

The most basic of Super resolution interpolation methods are the Bilinear or Bicubic interpolation techniques. But these techniques normally present us with overtly smooth images and images which have jagged artefacts. Another

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approach is to establish a relation between low resolution and high resolution image patches and form a machine learning technique establishing the relation between these patches. These methods forms a relation of the local geometry of high & low resolution patches and generates a high resolution patch as a linear combination of neighbouring patches.

The concept of sparse representation focuses on the problem of reconstruction of the super resolved version of the low resolution image. [2][3] It is based on the learning based dictionary methods which rely on patches from the input image. A compact representation of the high and low resolution patch pairs to capture the concurrence prior is studied instead of directly working with the high and low resolution patch pairs. This approach is based on the recent results in the domain of sparse representation of signals which suggest that a linear relationship among high resolution images can be accurately recovered from the low dimensional projections. Compared with the learning based methods, instead of using a large training patch database, the sparse representation algorithm only uses two compact learned dictionaries.

We can write the single image scale of problem as follows:

- Denote the original high-resolution image as y_h.
- Denote the blur and decimation operators as H and S.
- H is a low-pass filtering which we perform on the image and S is the decimation of the image which we perform by an integer factor s.
- z_l is the Noisy and low-resolution image obtained from the version of the original image y_h

Therefore, we denote the low resolution image obtained as z_l.

$z_l = SHy_h + v$, Where, v is an additive i.i.d. White Gaussian noise.

Given $\mathbf{z}_l$, the problem is to find a new image such that $y \approx y_h$. The maximum-likelihood estimation is obtained by the minimization of $\|\mathbf{SHy} - \mathbf{z_l}\|_2$ due to the inherent Gaussian nature of the Gaussian noise component v.

The Sparse-Land model is used for the scale-up problem in this paper as was introduced in [9], [10] and 11]. The basic assumption is that each of the patches from the images selected can be represented as a linear combination of patches from the dictionary i.e. each patch is obtained by multiplying the dictionary by a sparse vector of coefficients.

Often there is a problem in the resolutions of z_l and y_h. To avoid this issue, z_l is scaled up by Bicubic interpolation to realize into the same size as y_h. Let us now call this scaled up image as y_l instead of z_l. Let Q be the operator by which we work on z_l. Therefore,

$$y_l = Q.z_l = Q(SHy_h+v) = (QSHy_h+Qv) = X.\ y_h + v \ldots(1)$$

By using this algorithm, we can operate on patches extracted from $\mathbf{y}_l$ and therefore aiming to estimate the corresponding patch from $\mathbf{y}_h$.

6. Proposed algorithm for Super Resolution

This paper proposes to work on the sparse representation relationship between the high and low resolution patches and combine it with the intensity correction technique. The core idea of this concept is effectively given in [4]. Yang et. al. in [2] and [3] proposed that each Low and High resolution pair is sparsely represented over the dictionaries formed. The dictionaries A_h and A_l are a set of low and high resolution patch pairs. The basic idea is that the input image is converted into low and high resolution patch pairs and they are sparsely represented over the dictionaries A_h and A_l. Let al and ah be the resulting representation. In [2] and [3], the assumption is the invariance of the spare representation coefficient i.e. the input Low and high resolution patch pairs have same representation over the low and high resolution dictionary pair i.e. $\alpha_l = \alpha_h$. What these authors did was that they first learnt a dictionary A_l that best fits the LR patches and then using the same coefficient al they learnt a dictionary A_h that helped them to recover the HR patches.

In this case, the spare representations are taken as invariant in nature. But this assumption has its own flaws. When invariance is advocated, it means the number of items in both the dictionaries needs to be the same. Also, since low resolution images have a lot of low frequency components like textures and edges, a pre-processing stage is required which is usually in the form of a high pass filter. But in this paper, we are not having any assumption of the sparsity invariance. α_l is obtained and from this α_h is obtained by estimating the value of a_h. As a result, our dictionary sizes A_h and A_l can be of two different sizes. Therefore there is no restriction as such on the dictionaries.

Patch based reconstruction tries to get the high resolution image by combining high resolution patches p_{hk} i.e. p_{h1}, p_{h2}, p_{h3} etc. These high resolution patches are obtained from the corresponding low resolution patches p_{l1}, p_{l2}, p_{l3} etc. These patches are obtained from the high and low resolution images y_h & y_l. We assume $p_h = O_k y_h$ and $p_l = O_k y_l$ where O_k is a linear operator. Once all the high resolution patches p_{hk} are obtained, then the final high resolution image is obtained by taking an average of the overlapping patches. Thus, the basic scheme is that we can denote any signal **p** as a linear combination of a small number of atoms taken from the dictionary A which we have formed such that $p = A\alpha$, where α is the sparse representation vector. Thus, we can take any low resolution patch p_l and represent it over the low resolution dictionary A_l by using the sparse vector α_l and high resolution patch p_h can be represented over the high resolution dictionary A_h using sparse vector α_h. How to get α_l and α_h is what is to be determined and for this we use the statistical prediction method. Thus, we will be predicting the High resolution patches for every low resolution patch with the help of the LR and HR dictionaries. Therefore, we now find the low resolution coefficient α_l and then *using a statistical parametric model we find out the high resolution coefficient* α_h.

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Therefore the basic scheme that is followed in this paper is given as follows:

We can see that the implementation of the program can be seen as a feed forward network. If we denote the program as an algorithmic flow, then the following steps will form a part o the algorithm.

i. Start
ii. Input image y_h.
iii. From the input image y_h, decimate and blur the image by scaling factor q to get input LR image z_l
iv. Using scale factor q and bi cubic interpolation, generate $y_l=q.z_l$
v. Find overlapping patches p_{lk}.
vi. Compute the low resolution sparse coefficients α_{lk} from the low resolution patch p_{lk}.
vii. Use the MMSE estimator to get high resolution sparse coefficient α_{hk}.
viii. Obtain the high resolution patch $p_{hk}=A_h.\alpha_{hk}$
ix. Recover High resolution image y_{hk} by averaging the overlaps p_{hk}.
x. Stop

Now the input LR image to this entire algorithm is y_h. This image, before giving to the super resolution patch phase, is given to the intensity correction block as shown in Figure. No. 3. Any anomalies in the image w.r.t. Intensity irregularities are first rectified and only then does the super resolution phase occur. Thus a visually and computational better medical image is obtained and given to the super resolution stage. This forms the speciality of this paper. The end result is extremely well defined and intensity corrected when compared to the original image. Comparing mathematically in Section VII gives us the required increase in the values of PSNR and SSIM values. Also, visually, the recovered image when both intensity correction and statistical prediction type super resolution is carried out is far more superior as compared to any one of the above methods.

7. Outputs

7.1 Output of the Proposed Algorithm in which Intensity Correction is performed prior to the Super Resolution algorithm

The outputs shown in figure no. 4 were achieved for the flow chart of the proposed algorithm shown in figure no.3. The input to the sparse representation method, Statistical method and proposed algorithm was the resized form of the input image.

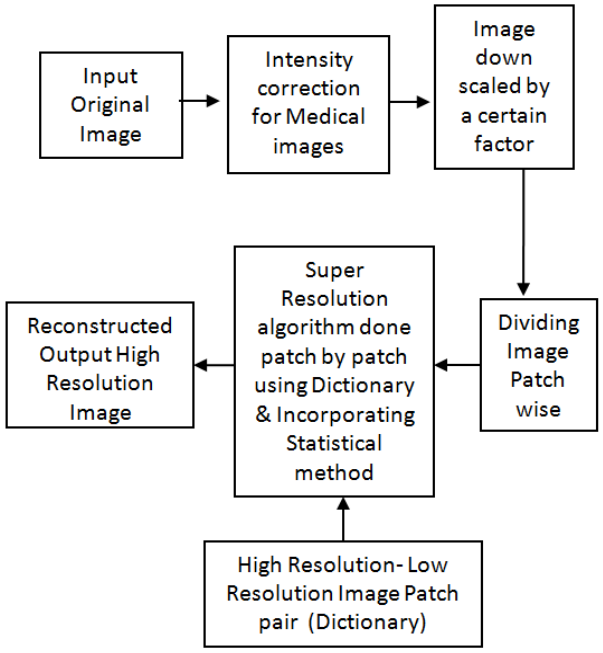

Fig. 3 Basic Block Diagram of the Proposed Method

Figure No. 4(a) shows the resized image of the original input image. This image is given to the Bicubic, Sparse representation, Statistical prediction Method. The output shown in figure no. 4(e) is of the proposed algorithm in which Intensity correction is done prior to Super resolution phase. The outputs obtained and the corresponding PSNR and SSIM are mentioned below in Table No I.

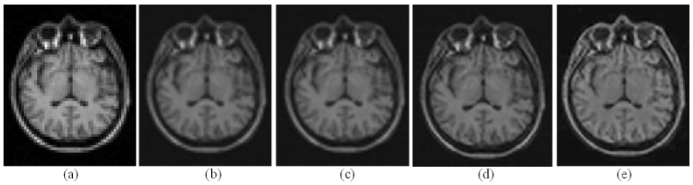

Fig. 4 Super Resolution of MRI image of shoulder: Resized version of Original image (a), Output of Bicubic (b), Output of Sparse Representation (c), Output of Statistical prediction method (d), Output of Proposed Method (e)

TABLE I
COMPARING THE PSNR & SSIM VALUES FOR BICUBIC INTERPOLATION, SPARSE REPRESENTATION, STATISTICAL PREDICTION& PROPOSED METHOD

Technique	PSNR (dB)	SSIM
Bicubic Interpolation	21.0676	0.4095
Sparse representation (ScSR)	21.5869	0.3802
Statistical Prediction	21.6122	0.4477
Proposed Method	23.7069	0.5038

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7.2 Output of the Proposed Algorithm when the Input image is subjected to Noise

In this part, we will see the performance of the Statistical Prediction method to Noise. The input image is subjected to Gaussian Noise to replicate the real world effect which is bound to occur while capturing medical images. The PSNR & SSIM when the input images are subjected to Gaussian Noise and Statistical prediction are shown in Figure 5 and Table II.

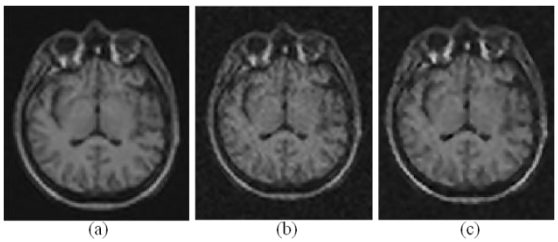

Fig. 5 Effect of adding Gaussian Noise to an Image for the Statistical Prediction Method. Output of Statistical Method (a), Noisy image given to Statistical Method (b) and Output of Statistical Method given to a Weiner Filter (c).

TABLE II
COMPARING THE PSNR & SSIM VALUES FOR THE DIFFERENT METHODS WHEN THE IMAGE IS SUBJECTED TO GAUSSIAN NOISE

Performance of Statistical Method	PSNR (dB)	SSIM
Without Noise	21.6122	0.4477
With Noise	20.312	0.4065
Weiner Filter used	20.3903	0.4084

Now, the performance of the proposed algorithm to Noise is checked. After Super Resolution by the proposed algorithm, the reconstructed image is given to a Weiner or Median filter to help improve the PSNR of the image. The Block diagram of this concept is given in figure no. 6. The corresponding outputs are given as in figure no. 7 and PSNR and SSIM values are mentioned in Table No. III.

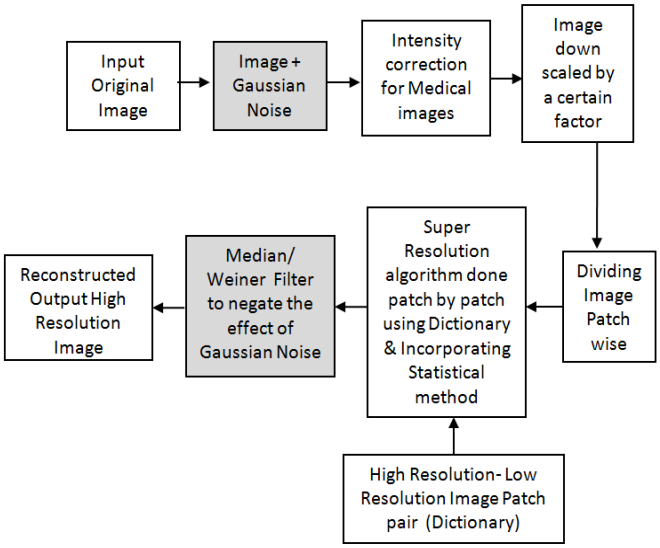

Fig. 6 Basic Block Diagram of the Proposed Method for an image added with Gaussian noise and then passed through an Averaging filter after the super resolution stage

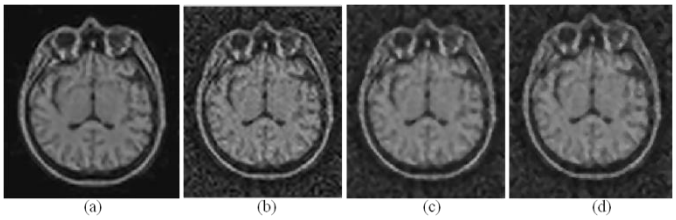

Fig. 7 Effect of adding Gaussian Noise to an Image in the Proposed Method (a), Noisy image given as input to the Proposed Method (b), Output of Proposed Method given to a Weiner Filter (c) and Output of Proposed Method given to a Median Filter (d).

TABLE III
COMPARING THE PSNR & SSIM VALUES WHEN THE IMAGE SUBJECTED TO GAUSSIAN NOISE IS PASSED THROUGH A WEINER OR MEDIAN FILTER AFTER THE SUPER RESOLUTION STAGE

Performance of Proposed Method	PSNR (dB)	SSIM
Without Noise	23.7069	0.5038
With Noise	17.4141	0.4152
Weiner Filter used	17.5713	0.4055
Median filter used	17.5424	0.4018

Figure no. 8 shows the time difference between Super Resolution methods via the Sparse Representation, Statistical Prediction method and proposed method. It is clearly seen that the proposed method takes less time than sparse representation method but far more time than the simple Statistical method. This is because of the fact that an additional computationally intensive task of Intensity correction is done prior to the super resolution stage. The increase in the quality of the output makes up for this higher computation time of the proposed method.

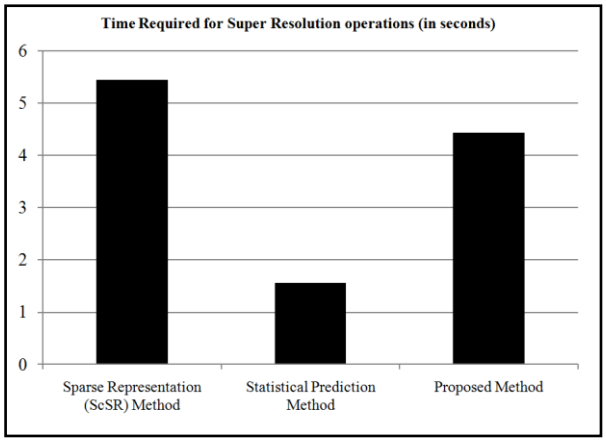

Fig. 8 Bar graph showing the comparison of the time taken for the Super Resolution Methods of Sparse representation (ScSR) and Statistical Prediction

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TABLE IV
COMPARISON OF THE TIME TAKEN TO COMPUTE THE RECONSTRUCTED IMAGE BY THE EXISTING AND PROPOSED SUPER RESOLUTION METHODS

Method	Time taken (sec)
Sparse representation (ScSR)	5.4414
Statistical Prediction	1.552
Proposed Method	4.4338

8. Conclusion

This paper consists of combining the benefits of intensity correction along with the statistical prediction method. The benefit of the Statistical prediction model is that the invariance model used to find the high resolution sparse coefficient is not considered. Image scaling up is done with the help of the algorithm wherein the LR patches are converted into the HR patches through the sparse coefficients. Also, the usage of the intensity correction prior to the super resolution stage helps to perform intensity uniformity and removes any intensity irregularities. More intense use of neural network has also been suggested for image denoising. Even though the time required for our proposed algorithm is more than for standalone systems, the added benefit of intensity correction negates this shortcoming.

High resolution is of paramount importance for medical images. A medical image with a high resolution is used for better diagnosis of the ailment. Therefore the concept of Super Resolution finds great acceptability in overcoming the problem of low resolution.

The future scope of this method of applying SR techniques is tremendous. One can develop newer and better algorithms for the continuous enhancement of the image parameters like PSNR and SSIM, thereby making this field challenging and evolving.

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Intelligent and Dynamic Neighbourhood Entry Lifetime for Position-based Routing Protocol Using Fuzzy Logic Controller

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Abstract—**Mobile Ad-hoc Network (*MANET*) characterized with high mobility and very limited resources. Such network requires a very high reliable routing protocol to be compatible with its limitations. In position-based routing protocols for *MANET*, each node chooses the next relay node for packet routing solely from neighbourhood stored in its neighbours' matrix (*NLM*). The lifetime of neighbors' entry in *NLM* matrix relates to beacon interval and timeout interval. Inaccurate information of *NLM* matrix may lead to a wrong selection decision, which can have devastating consequences on *MANET* resources. Thus, the freshness of the information in a node's *NLM* matrix is in a high demand. This paper presents an intelligent dynamic fuzzy logic controller refreshment period of entries in neighbourhood matrices (*IFPE*) scheme. The *IFPE* algorithm utilizes neighbour's Residual Lifetime of Links (*RLT*) in the fuzzy logic controller as an input, and the called neighbour expire entry life-time (*ELT*) as an output. Simulation results show that *IFPE* algorithm keeps neighbourhood matrices consistent, which achieve considerable improvement for position-based routing protocols performance.**

***Index Terms*— Networks, Mobile Ad-hoc Network, Position-based Routing, Residual Lifetime of Links, Entry life-time.**

I. Introduction

Mobile Ad-hoc Networks *MANETs* are networks formed without a central administration. They consist of mobile nodes in the fly [1,2,3,4]. Due to the limited radio transmission range of wireless devices, such nodes, can communicate directly if they are within the transmission range of each other, otherwise they will indirectly communicate by using intermediate nodes [5,6,7]. In *MANET* all nodes participate in the routing and data forwarding process [8,9].

As a node joins *MANET* it has to announce its presence by emit HELLO message for all of its neighbours in its transmission range. Also, it should start building its own neighbours matrix to efficiently communicate with the others. The building of a node's neighbour's matrix is totally depended on the received HELLO messages from the neighbourhood. To improve routing protocol efficiency, the entries in the neighbours' matrix should be checked periodically by a node to be sure that it does not contain stale entries [10,11]. Also to solve the outdated entries problem, the frequency at which an entry is considered as stale one should be tuned, and not be considered as a fix pre-specified time. In this paper, we present an intelligent dynamic fuzzy logic controller refreshment period of entries in neighbourhood matrix (*IFPE*) as an extension to Greedy perimeter stateless routing protocol (*GPSR*) [12]. *IFPE* Algorithm adapts dynamically the residual link lifetime of neighbours in a node's neighbours' matrix.

The outline of this paper is as follows. In Section II, we present the related works. In Section III, we introduce and describe the proposed technique *IFPE*, while in Section IV; we describe the simulation environment. In Section V we crop the results and discuss them. Lastly, we conclude this work with a small hint for future works in Section VI.

II. Related Work

The neighbours' matrix is checked periodically by a node to update (add/delete) it. A node considers all others nodes in its neighbours' matrix as active neighbours and thus, a link between them is active. In the literature, researchers as in [13,14,15] use a fixed interval time to remove a neighbour from a nod's neighbor matrix in the case of no reception of a HELLO message. In those works the neighbours' expire entry life-time is set as three times of the HELLO message frequency period (*FBIT*). Such pre-specified period of time is in sufficient for adaptively follow the dynamic environment of *MANET*. Moreover, it degrades the performance of the underlying routing protocol used by participating nodes to accomplish the communication task with each other.

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The expiry entry lifetime of neighbours is much related to the frequency of emitting HELLO messages interval time (*FBPIT*). In the state of the art researchers adapt several algorithms to adaptively estimate *FBPIT*. Chen et al. [16] proposed Adaptive Position Update (*APU*) strategy, which used mobility prediction rule to estimate the accuracy of the position information and to adapt the *FBPIT* accordingly. Saqour R. et al. [17] proposed fuzzy Hello Interval method to adjust the time between the transmissions of beacon packets. They proposed Fuzzy logic-based dynamic beaconing (*FLDB*) controller in order to overcome the drawbacks of periodic beaconing (*PB*) in the ad hoc position-based routing protocols. Chou et al. in [18], proposed an approach for beacon-based geographic routing, where the mobile nodes dynamically adjust their beacon intervals based on their speed of movement. J. Tang, et al., in [19], presented an adaptive beacon exchange algorithm. Authors gave a computable method to adjust the beacon interval according to node speed and relative position. S. Bai, Z. Huang, and J. Jung in [20], presented a mobility predication-based dynamic beacon strategy (*BCF*). When executing *BCF* a node can decide the beacon sending period value according to its direction and speed. As we can noticed here that several works have been proposed to adapt the frequency of the HELLO message in *MANET*, but none of them adapts the *ELT* of entries of nodes in neighbour's matrix.

III. Intelligent Dynamic Fuzzy Logic Controller Refreshment (IFPE)

The lifetime of the entries of a neighbour in a nod's neighbours' matrix is very important and may severely affect the performance of position based routing protocol. Consequently, routing failures is proportional to the inappropriate decision of removing a neighbour's entry from a node's neighbours' matrix. Our proposed *IFPE* aims to adapt dynamically the lifetime of entries in neighbourhood matrix regarding to *RLT* of neighbours. If *RLT* of a neighbor is high, then the *ELT* will be high too and vice versa.

A. IFPE Overview

With traditional position-based routing protocols a node set its timer to send HELLO message according to *FBPIT*. The received node keeps the information of the HELLO packet in its neighbours' table. With our proposed scheme, we make some alteration for the HELLO packet as shown in Table 1 bellow. Moreover, some alteration is done for the neighbours' table as shown in equation 1, and it is re-named as neigbours' matrix.

TABLE I
HELLO MESSAGE STRUCTURE

1	2					3	4
ID_i	x	y	$vel.$	$acc.$	$dir.$	$FBPIT$	t_s
	x_{ts}^i	y_{ts}^i	v_{ts}^i	a_{ts}^i	θ_{ts}^i	t_b	

As depicted in TABLE I, HELLO message holds the following fields. Node's address ID, Nodes' identity with updating sequence number ID_i, the geographical position of the node as (x,y) coordinates, velocity v, acceleration a, motion direction θ, *FBPIT* Interval Time t_b, beacon sending time t_s. Each node stores a neighbour' matrix (*NLM*) to save the received HELLO messages from its neighbours. Equation 1 shows the building structure of the node's neighbours' matrix for i neighbours.

$$NM = \begin{bmatrix} x_1 & y_1 & v_i & a_i & \theta_i & RLT_1 & ELT_1 & t_{b_1} & t_s & t_r & ID_1 \\ x_2 & y_2 & v_i & a_i & 1\theta_i & RLT_2 & ELT_2 & t_{b_2} & t_s & t_r & ID_2 \\ . & . & . & . & . & . & . & . & . & . & . \\ . & . & . & . & . & . & . & . & . & . & . \\ x_i & y_i & v_i & a_i & \theta_i & RLT_i & ELT_i & LBPIT_i & t_S & t_r & ID_i \end{bmatrix} \quad (1)$$

As depicted in equation 1, *NLM* contains all HELLO message information for each neighbour, adding the instant time (t_r) that the node receives the HELLO message. Also the received node adds *RLT* and *ELT* value for each neighbor. This addition is done after a node received HELLO packet and calculates *RLT* and run IFPE algorithm to find out *ELT*. The numbers of neighbours sent HELLO messages are equal to the rows' number of *NLM* matrix.

B. ELT Calculation Using Fuzzy Logic

Recall from the state of the art, many routing protocol parameters in *MANET* adaptively optimized by using the fuzzy logic controller. Fuzzy controller assists to determine more accurately and dynamically of those parameters. Thus, using fuzzy logic is promises to adapt the neighbour expire entry life-time (*ELT*) based on its *RLT*.

To adapt the neighbor expiry entry life-time *ELT*, in this section fuzzy logic controller is used. This adaption achieves a good balance between acceptable *ELT*, and *RLT*. An *IFPE*, as a *FLC* approach to adapt the neighbour *RLT* is utilized as crisp input and *ELT* period time as a crisp output. Nodes have high *RLT* will stay more time in each other transmission range, thus *ELT* will be high and vice versa. Fig. 1 shows the *FLC* for *IFPE* approach.

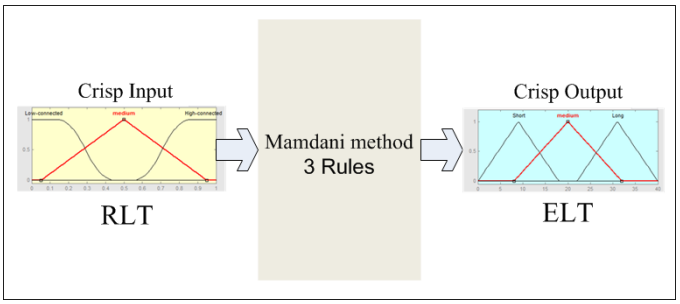

Fig. 1. FLC for IFPE

C. Residual Lifetime of the Link between Two Nodes Identification

In mobile ad hoc network pair of nodes i and j can be directly communicate if the maximum distance between them less than transmission range R. The actual distance (des_j^i) between them can be calculated by using the positions of the two nodes. Link life-time or link expiration time between nodes i and j can defined as the maximum time of connectivity between the two nodes before one of them leave the transmission range of the other node [21]. In this work, link expiration time between nodes i and j is define as residual

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lifetime of the link between the two nodes. As shown in Fig. 2, it assumed that nodes *i* and *j* are neighbours. Also, it assumed that the current information of nod *j* as reported in the latest HELLO message for node i is $(x_t^j,\ y_t^j,\ v_t^j, a_t^j,\ \theta_t^j)$ at time *t*. At the same time the node-self information is$(x_t^i,\ y_t^i,\ v_t^i,\ a_t^i,\ \theta_t^i)$.

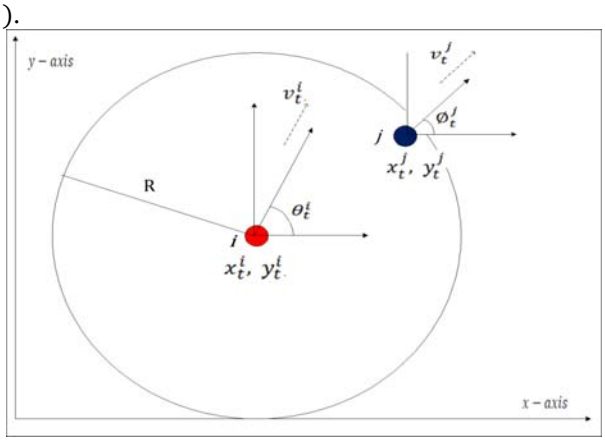

Fig. 2. Communication relation and RLT of a link between pair of nodes

To estimate the *RLT* between the two nodes, work presented in [20] was adopted with some alteration, as shown in equation 2 bellows.

$$RLT_j^i(t) = \frac{R - des_j^i(t)}{RV_j^i(t)} \quad (2)$$

Where, $RLT_j^i(t)$ is the residual lifetime of the link between node *i* and node *j* at time *t, R* is the transmission range of the nodes, $des_j^i(t)$ is the current distance between node *i* and node *j* at time *t*, and $RV_j^i(t)$ is the magnitude of the relative velocity (speed and direction) between nodes *i* and *j* at time t. The distance between the two nodes i, and j can be estimated as in equation 3 bellows.

$$des_j^i(t) = \sqrt{(x_t^i - x_t^j)^2 + (y_t^i - y_t^j)^2} \quad (3)$$

The relative velocity between the two nodes i, and j can be estimated as in equation 4 bellows.

$$\overrightarrow{RV_j^i} = \vec{V_i} + \vec{V_j} \quad (4)$$

The magnitude of the relative velocity is,

$$RV_j^i = \sqrt{\left(RV_i^i(x)\right)^2 + (RV_i^S(y))^2} \quad (5)$$

Where,

$$RV_j^i(x) = (v_i \cos\theta - v_j \cos\emptyset) \quad (6)$$

$$RV_j^i(y) = (v_i \sin\theta - v_j \sin\emptyset) \quad (7)$$

where, $RV_i^i(x)$ is node's *j* relative velocity in the x-direction for node i, and, $RV_i^S(y)$ is node's *j* relative velocity in the y-direction for node *i*, v_i and v_j are the velocity of nodes *i* and *j* respectively, θ and $\emptyset$ are the motion direction of nodes *i* and *j* respectively.

Rearranging algebraically of Equation 2, leads to the result;

$$RLT_j^i = \frac{\left(R - \sqrt{(x_t^i - x_t^j)^2 + (y_t^i - y_t^j)^2}\right)}{\sqrt{(v_t^i \cos\theta_t^i - v_t^j \cos\emptyset_t^j)^2 + (v_t^i \sin\theta_t^i - v_t^j \sin\emptyset_t^j)^2}} \quad (8)$$

Owing the variation of the speed, or motion direction (velocity) of the neighbor, the *RLT* will be varying too. To specify the *ELT* of a neighbour, three possibilities were been considered:

1) If *RLT* period of neighbor j with node *i* is long, this means that it has approximately similar values of speed and motion direction with respect to node *i*. In such case, waiting time *ELT* for neighbor j will be long too. A very important thing to be noticed here is that if the velocity vectors of the two nodes are equal, the value of *RV* is equal zero. In such case the *RLT* period will goes to infinity.
2) If *RLT* period of neighbor *j* with node *i* is medium, this means that it has some different values of speed and motion direction with respect to node *i*. In such a case, waiting time *ELT* for neighbor *j* will be medium.
3) If *RLT* period of neighbor *j* with node *i* is low, this means that it has high different values of speed and motion direction with respect to node *i*. In such a case, waiting time *ELT* for neighbor *j* will be short.

In this paper the used velocity range is [1,40] m\s, and thus, the maximum and minimum magnitude of the relative velocity between two nodes is 80, and 2 respectively. Furthermore, the used transmission range is fixed for all participating nodes (R=250 m). And thus, the *RLT* range with maximum magnitude of the relative velocity is [3.125s, 125s]. Also, the range of the *RLT* with minimum magnitude of the relative velocity is [0.5s, 0.0125s]. As a consequence, the total range of the proposed *RLT* is [0.0125s, 125s]. To map *RLT* range to [0,1], as a normalization process, the following formula in Equation 999, is used.

$$\Im_j^i(t_s) = \frac{(x - \min\{0.0125s, 125\})}{(\max\{0.0125s, 125\} - \min\{0.0125s, 125\})} \quad (9)$$

Where, $\Im_j^i(t_s)$ is the normalized value of the relative velocity magnitude between the nodes *i*, and *j* at time *t*. The nodes are fully connected if the $\Im_j^i$ is 1 and likely out of transmission range of each other if the $\Im_j^i$ is 0. Thus, high values of $\Im_j^i$ gives an indicator for the high reliability value of communication via this neigbour.

IV. Intelligent Fuzzy Logic Decision

As discussed earlier, the HELLO sending frequency is much related to the waiting time before a node deletes any neighbour's entry from its neighbours' matrix. From literature,

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most researchers use the frequency from the interval *LPBIT* [1-10 s] second. Moreover, most of those researchers used the waiting time to be three times of the frequency sending (*3* LPBIT*). As consequence, the most-used waiting time is bounded in the interval [3-30 s] second. To cater for this research demand, the waiting time adjusted to being more realistic in the interval [1-40 s]. Thus, the neighbor has high $\mathfrak{I}_j^i$ will also have long *ELT* time. To estimate the *ELT* time index for a neighbor, the corresponding entry will be evaluated by the Inelegant Fuzzy Logic Controller *IFPE*. The crisp input will be the $\mathfrak{I}_j^i$ of the neighbour. The crisp output from the fuzzy controller will be the *ELT* time index for that neighbor.

A. Fuzzify Input and Output Parameters

The fuzzifier maps the crisp data values to fuzzy sets and assigns degree of membership for each fuzzy set. Here $\mathfrak{I}_j^i$ is the crisp input and *ELT* time is the crisp output the linguistic values of inputs are normalized in the range from 0 to 1, and outputs in the range from 1 to 40 s.

B. Fuzzify Neighbours' $\mathfrak{I}_j^i$ Input

Membership functions can have different shapes. Fig. 3 shows the assignment of degree of membership functions for input used in this work. The triangular membership function is used to represent the whole set of medium values. Z-shaped is used to represent the whole set of low values, and S-shaped is used to represent the whole set of high values.

TABLE II
FUZZY SETS FOR I_J^I INPUT VARIABLE

Range	Fuzzy sets	Symbol
0.035-0.45	Low	*lo*
0.08-0.92	Medium	*md*
0.55 0.965	High	*hi*

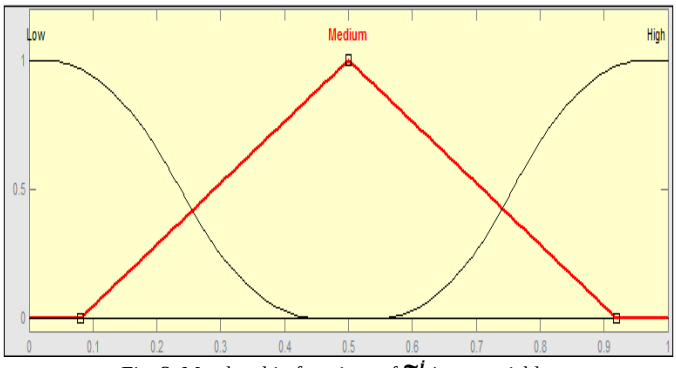

Fig. 3. Membership functions of $\mathfrak{I}_j^i$ input variable

The fuzzy sets for the *RLT* input variable have the following names: low (*lc*), medium (*m*), and high *(hc*). Table 2 shows the assignment of range of membership functions for input $\mathfrak{I}_j^i$ variable. Hence, the $\mathfrak{I}_j^i$ is fuzzified between $\mathfrak{I}_j^i$*-min = zero* and $\mathfrak{I}_j^i$*-max = 1*.

Equations 10 to 12 show the explicit formulas for $\mathfrak{I}_j^i$ membership functions.

$$\mathfrak{I}_{j\,lo}^i = \begin{cases} 1, & x \le 0.035 \\ 1 - 2\left(\frac{x-0.035}{0.45-0.035}\right)^2, & 0.035 \le x \le \frac{0.035+0.45}{2} \\ 2\left(\frac{x-0.45}{0.45-0.035}\right)^2, & \frac{0.035+0.45}{2} \le x \le 0.45 \\ 0, & x \ge 0.45 \end{cases} \quad (10)$$

$$\mathfrak{I}_{j\,md}^i = \begin{cases} \left(\frac{x-0.08}{0.5-0.08}\right), & 0.08 \le x \le 0.5 \\ \left(\frac{0.92-x}{0.92-0.5}\right), & 0.5 \le x \le 0.92 \\ 0, & otherwise \end{cases} \quad (11)$$

$$\mathfrak{I}_{j\,hi}^i = \begin{cases} 0, & x \le 0.55 \\ 2\left(\frac{x-0.55}{0.965-0.55}\right)^2, & 0.55 \le x \le \frac{0.55+0.965}{2} \\ 1 - 2\left(\frac{x-0.965}{0.965-0.55}\right)^2, & \frac{0.55+0.965}{2} \le x \le 0.965 \\ 1, & x \ge 0.965 \end{cases} \quad (12)$$

C. Fuzzify Neighbours' ELT Value Output

Fig. 4 shows the assignment of degree of membership functions for output used for this work. The triangular membership function is used to represent the whole set of medium, low, and high values. Fuzzy sets for the *ELT* output variable have the following names: long (*l*), medium (*m*), short (*s*). Table 3 shows the assignment of rang and membership functions for output *ELT* variable. Hence, the *ELT* is fuzzified between *ELT-min = 1* and *ELT-max = 40*.

TABLE III
FUZZY SETS FOR ELT OUTPUT VARIABLE

ELT value	Fuzzy sets
0.0 - 18	Short *(s)*
8 - 32	Medium (*m*)
22 - 40	Long *(l)*

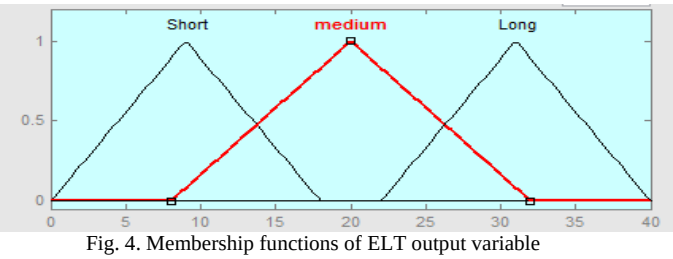

Fig. 4. Membership functions of ELT output variable

Equations 13 to 15 show the explicit formulas for $\mathfrak{I}_j^i$ membership functions.

$$ELT_s = \begin{cases} \left(\frac{x-0.0}{9-0.0}\right), & 0.0 \le x \le 9 \\ \left(\frac{18-x}{18-9}\right), & 9 \le x \le 18 \\ 0, & otherwise \end{cases} \quad (13)$$

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$$ELT_m = \begin{cases} \left(\frac{x-8}{20-8}\right), & 8 \le x \le 20 \\ \left(\frac{32-x}{32-20}\right), & 20 \le x \le 32 \\ 0, & otherwise \end{cases} \quad (14)$$

$$ELT_l = \begin{cases} \left(\frac{x-22}{31-22}\right), & 22 \le x \le 31 \\ \left(\frac{40-x}{40-31}\right), & 31 \le x \le 40 \\ 0, & otherwise \end{cases} \quad (15)$$

D. Fuzzy Rules and Fuzzy Inference

Fuzzy inference uses the following proposed fuzzy rules to map the fuzzy $\Im_j^i$ input sets mentioned above into fuzzy *ELT* output sets: Long, medium, and short.

RULE 1: IF $\Im$ is *high* THEN *ELT* is *long*
RULE 2: IF $\Im$ is *medium* THEN *ELT* is medium
RULE 3: IF $\Im$ is *low* THEN *ELT* is *short*

Fuzzy inference evaluates all the three fuzzy rules (RULE 1 to RULE 3) and finds their antecedent part firing strength then applies this firing strength to the consequence part of the rules.

E. An Illustrative Example for IFPE

This sub-section explains the operations of *FLC* used for *IFPE* approach. In this example suppose that the estimated $\Im_j^i$ basing on Equation 999 is 0.2.

Step 1. Fuzzify the inputs: with this step the input $\Im_j^i = 0.2$ insert as crisp input to *FLC* to determine the degree to which it belongs to each of the appropriate fuzzy sets via its membership functions. The Fig. 5 below shows how well the $\Im_j^i = 0.2$ qualifies via its membership functions (low-connected, medium, and high-connected). In this example, the rating of $\Im_j^i = 0.2$ produces corresponds to two membership functions: low-connected and medium with value 0.915 and 0.33 respectively.

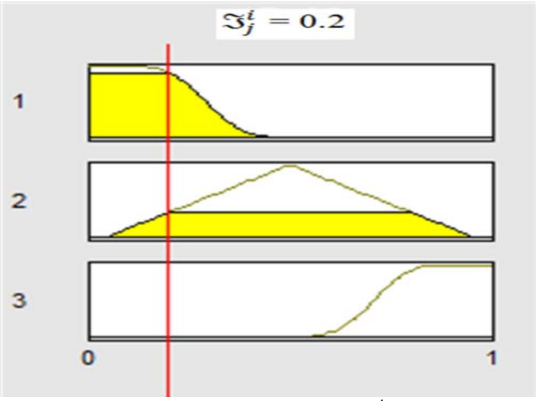

Fig. 5. Fuzzification of the $\Im_j^i$

Step 2. Apply fuzzy inference: After the $\Im_j^i$ input fuzzified, the fuzzy inference evaluates all the three fuzzy rules (RULE 1 to RULE 3) and find their antecedent part firing strength (membership functions values) then apply this firing strength to the consequence part of the rules. For example, in the input $\Im_j^i = 0.2$, two rules will be fired (Rule 1 and Rule 2) with antecedents' firing strength equal to 0.915 and 0.33 respectively as shown in Fig. 6. The fuzzy inference then applies those values (0.915, 0.33) to the consequence part to find the firing strength of each rule.

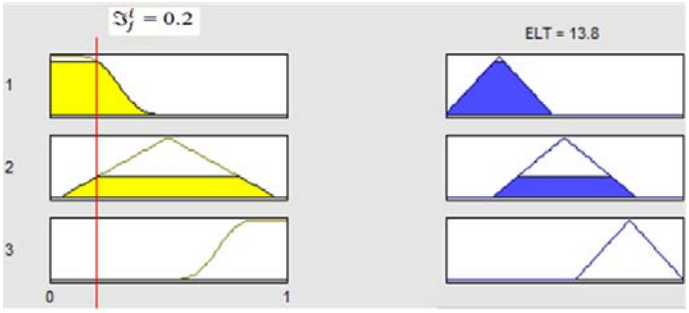

Fig. 6. Applying fuzzy inference

Step 3. Defuzzify the outputs: in this step, all the fuzzy sets that represent the outputs of each rule are aggregated into a single output fuzzy set and then the single output fuzzy set will be defuzzified to get a single output value. As shown in Fig. 7, all the output *ELT* fuzzy sets which obtained from applying fuzzy inference in step 2 are aggregated to obtain a single output *ELT* fuzzy set. After that, the weighted average defuzzification method is applied to get a single output *ELT*.

$$ELT = \frac{\sum_{j=1}^{w} x_j \cdot \mu(x_j)}{\sum_{j=1}^{w} \mu(x_j)} = \frac{(0.33 * 9) + (0.915 * 20) + (0.00 * 31)}{(0.33 + 0.915)} = 14s \quad (16)$$

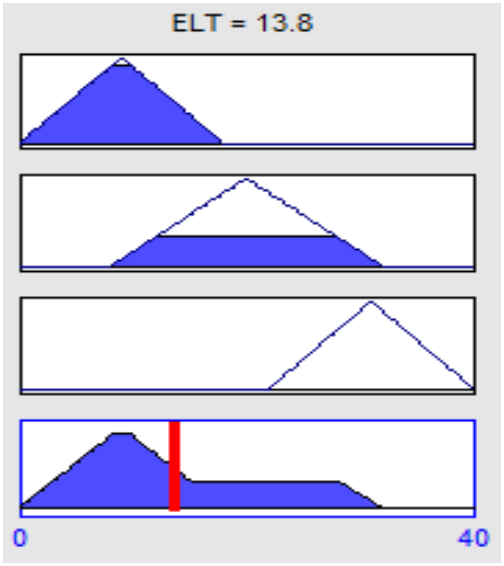

Fig. 7. Aggregation and defuzzification of the output ELT

V. Performance Analysis of the Proposed GPSR-IFPE

A. Simulation Environment

The simulations were conducted using *Ns2* version 2.33. The *GPSR* protocol is utilized as the underlying routing

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protocol. With the conventional *GPSR* the *FBPIT* interval and the *ELT* interval are set to 3s and 9s (*3*FBPIT*) respectively. The nodes move according to the Boundless mobility model. The fuzzy logic system has been coded using *C++*. Centroid was chosen as the defuzzification method [22]. All simulation results have been averaged over 10 simulation runs and include 95 percent confidence interval data.

The simulation network area is rectangle of 2500 m × 2000 m, with 250m nodes' transmission range. We use the *MAC* layer protocol 802.11 *DCF RTS/CTS*. Bandwidth (*Bw*) set to standard value of 2 mbps. Traffic model uses Continuous Bit Rate (*CBR*) traffic sources. Traffic sources transmit data at a fixed data rate of 5 packets/s. Data packet size set to standard values 512 bytes and beacon packet size is 64 bytes. Node queue size set to standard size of 50 packets and node's queue uses First-In-First-Out (*FIFO*) policy. The simulation for each scenario is executed in a period of 1200, seconds, and to avoid the effect of initializing and ending, we only gather the data between 800s – 1000s.

B. Simulation Scenarios

To study the effectiveness of *IFPE* approach in position-based routing protocols using *FLC*, a simulation study conducted varying node speed, number of nodes, and number of data traffics. Node speed 5, 10, 15, 20, 25, 30, 35, 40 m/s, number of nodes 25, 50, 75, 100, 125, 150, 175, 200 nodes, and number of data traffics 5, 10, 15, 20, 25, 30 flows are simulated . There are no obstacles and so nodes with transmission range can always communicate. The source and destination nodes were randomly selected among the nodes in the simulation scenario.

The reason why we use high-speed interval, various node density and different traffic load is to have a challenging scenario for the routing algorithms to show the goodness of the routing protocol under study.

C. Performance Evaluation Metrics

In this work's simulations, we focused on selecting performance metrics that reflect the goal of the designed algorithm. For *MANETs* evaluation sake a vast discussion was stated in *RFC* 2501 [23,24]. In *RFC* 2501 a basic fundamental consideration about routing protocol performance issues and evaluation were discussed which we adopted in selecting this work performance metrics. Based on the proposed mechanisms to improve greedy, the performance evaluation metrics were carefully derived and stated below.

1) Packet Delivery Ratio:

Packet delivery ratio (*PDR*) represents the ratio between the number of packets originated by the *CBR* sources and the number of packets successfully received by the *CBR* sink at the final destination by the used routing algorithm as a function of node speed, number of nodes, and data traffics load. The *PDR* is computed as shown in equation 17.

$$PDR = \frac{\sum Number\ of\ received\ packets\ at\ destination\ node}{\sum Number\ of\ packets\ sent\ by\ source\ node} \quad (17)$$

2) End-t- End Delay:

The End-To-End (*E-2-E*) delay metric is used to show the difference between the time a data packet is received by the destination (T_D) and the time the data packet is generated by the source (Ts) through the used routing algorithm as a function of node speed, number of nodes, and data traffics load. The *E-2-E* delay time includes; the buffer delay, node processing delay, the bandwidth contention delay at the *MAC*, and the propagation delay. To calculate *E2E-D* for one received packet at the destination side, equation 18 is used.

$$E2E\ Delay = T_D - T_S \quad (18)$$

Where, *E-2-E* Delay represent the delay time, T_D represent the time a packet is received at destination side, T_S represent the time a packet is sent from source side.

3) Nodes' Neighbours Matrix Credibility:

To evaluate the goodness of the used routing algorithm, an investigation is done to show the ability of the compared routing algorithms to keep the consistency of node's neighbours' matrix. Nod's Neighbours Matrix Credibility (*NMC*) represents the ratio number of false neighbours remains in a node neighbourhood matrix (not removed yet) which already leaves its transmission range to the total number of a node's entries in its neighbours' matrix, as a function of node speed, number of nodes, and data traffics load. The *NMC* metric influence other metrics such as *PDR* and *E-2-E* delay when selecting wrong next relay node. And thus, in this aspect, the *NMC* metric is essential to show the routing algorithm reliability and efficiency.To explain this metric, suppose that the degree of node i is $|N(i)|$ defined as its entire neighbor in its transmission range. Also, suppose that the neighbors that are listed in the node's i neighbours matrix is $N^*(i)$. To calculate the *NTC* at time *t* the equation 19 bellow is used.

$$NTC(i,t) = \frac{(N^*(i,t)) \,/\, (N(i,t)}{N(i,t)} \quad (19)$$

Where, $N(i,t)$ is node i degree at time *t,* $N^*(i,t)$ is the number of neighbours listed in node *i* neighbours matrix at time *t*, this metric is computed at specific instance time during simulation time (after starting the simulation and reach the steady state (i.e. at; 250s, 500s, 750s). At those selected time a snapshot for the simulation is taken to find the $N(i,t)$ and the $N^*(i,t)$. These two values were collected randomly for 10 nodes. The reason why, because in any experiment and after reaching the steady state the collected information for any node in the environment should show same result since all participating nodes works under same conditions as related for each scenario. Next, we used the equation mentioned above to calculate *NTC*.

VI. Simulation Results

A. Packet delivery ratio

Fig. 8 shows the performance analysis of the achieved packet delivery ratio as a function of node moving speed for the *GPSR* and *GPSR-IFPE*. The result shows that *GPSR-IFPE* is much better than the *GPSR* protocol. This is because that *GPSR* needs to retransmit data packets that are lost due to

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the node's mobility. As node's mobility increases, the topology will change fast too. As topology change very fast, because using *FBPIT*, the position information of the neighbours in *NLM* matrix will become stale very fast. Selecting one of these stale neighbours as a next relay node will result in sending the data packet to inaccurate position that causes the packet to be dropped. On the other hand, with *GPSR- IFPE*, using fuzzy logic is adaptively and dynamically updates the *ELT* in a node's *NLM* matrix based on neighbours' mobility changes. *GPSR-IFPE* achieves more 95.4% in the packet delivery ratio due to the *IFPE* algorithm that increases the accurate information in a sender's *NLM* and avoids routing the data packet to inaccurate neighbours.

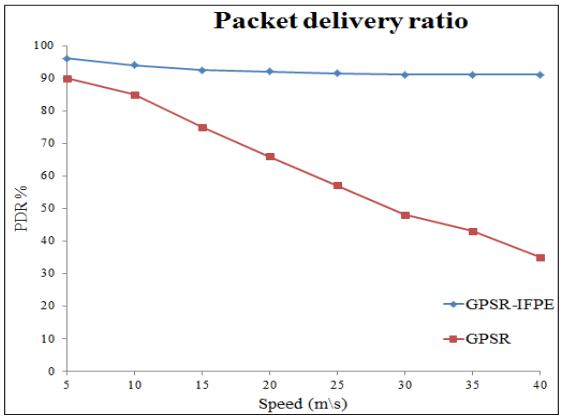

Fig. 8. Performance analysis of the achieved packet delivery ratio as a function of node moving speed for the GPSR and GPSR-IFPE.

Fig. 9 shows the performance analysis of the achieved packet delivery ratio as a function of the number of nodes. The figure shows that *GPSR- IFPE* is much better than the *GPSR* protocol. When using *GPSR* and as the a sender's degree increases the number of outdated neighbours in its *NLM* increase too, and thus the probability to select one of these outdated neighbours as the next relay node will increase too. Selecting one of these stale neighbours as the next relay node will result in sending the data packet to inaccurate position that causes the packet to be dropped. On the other hand, with *GPSR- IFPE* using fuzzy logic make the *ELT* of the neighbours in node's neighbours' matrix will be adaptively and dynamically update regardless of the sender's degree. *GPSR-IFPE* achieves more 92% in the packet delivery ratio due to the *IFPE* algorithm that increases the accurate information in a sender's *NLM* and avoids routing the data packet to inaccurate neighbours.

Fig. 10 shows the performance analysis of the achieved packet delivery ratio as a function of data traffics. For both protocols, as the number of flows increases, the number of packets in the network to be rerouted increases too. This increment in the traffic results congestion at the center of the network that increases the probability of packet loss. Thus for both protocols as the number of flows increases this means more packet loss. Another thing to be mentioned that while using *GPSR*, the used outdated neighbours as next relay nodes will significantly increase which increase the dropped packets. On the other hand, while using *GPSR-IFPE*, since the information of the neighbours in any node's *NLM* is always accurate, thus the routed packet will be correctly reached their final targets. And thus, *GPSR-IFPE* protocol achieves the highest packet delivery ratio.

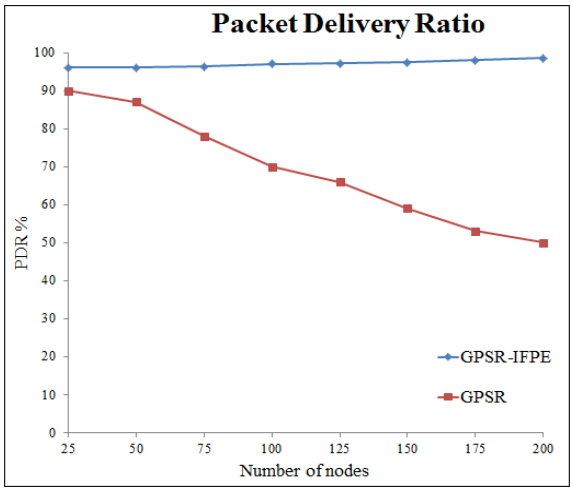

Fig. 9. Performance analysis of the achieved packet delivery ratio as a function of the number of nodes.

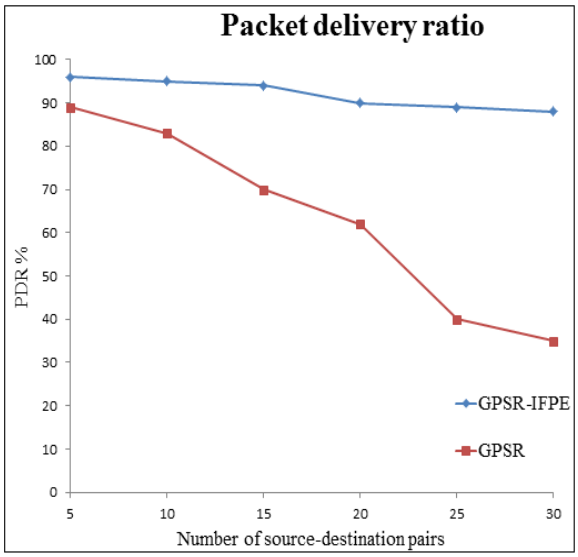

Fig. 10. Performance analysis of the achieved packet delivery ratio as a function of data traffics.

B. *End-To-End Delay*

Fig. 11 shows the average end-to-end delay in *GPSR* and *GPSR-IFPE* protocols as a function of node speed. The figure shows that *GPSR-IFPE* significantly decreases the average end-to-end comparing to *GPSR*. The reason why refer to the fact that when using *GPSR* and as the neighbours' mobility increases the number of outdated neighbours in a sender *NLM* increase too. During packet routing, the sender node selects a neighbour for the next hop. If an outdated neighbouring node is selected as the next relay one, the routed data packet will be lost. As a consequence, the sender node will retransmit the lost packet again up to 7 times, this will increase the delay since during those retransmission the data packet is buffered for extra time. After several retransmitting for routed data packet

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to outdated neighbouring node, the *MAC* layer would report that the next hop is unreachable, causing the sender node to pick a different neighbour and reroute the data packet again which required another extra time resulting in a significant longer average end-to-end delay. On the other hand, as the nodes' mobility increases while using *GPSR-IFPE* this will activate the *IFPE* algorithm functionality to track and remove the outdated neighbours in the senders' *NLM* very fast and in a timely manner. As a consequence, this will decrease the number of outdated neighbours in the sender's *NLM*. Therefore, the outdated neighbouring node can be avoided to be selected as the routing node compared to the *GPSR*. And thus, during packet routing, the sender node selects an accurate neighbour for the next hop from its *NLM*. *GPSR-IFPE* achieves less 95.4% in average end-to-end delay due to the *IFPE* algorithm that increases the accurate information in a sender's *NLM* and avoids routing the data packet to inaccurate neighbours.

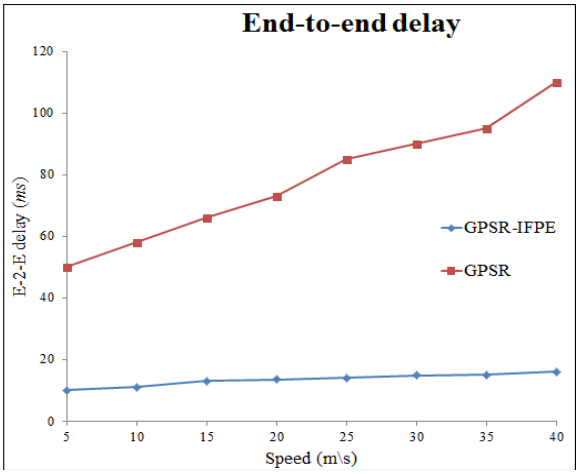

Fig. 11. average end-to-end delay in GPSR and GPSR-IFPE as a function of node speed.

Fig. 12 shows the average end-to-end delay in *GPSR* and *GPSR-IFPE* protocols as a function of the number of nodes. The figure shows that *GPSR-IFPE* significantly decreases the average end-to-end comparing to *GPSR*. The reason why refer to the fact that when using *GPSR* and as the sender's degree increases the number of outdated neighbours in its *NLM* increase too, and thus the probability to select one of these outdated neighbours as the next relay node will increase too. If an outdated neighbouring node is selected as the next relay one, the routed data packet will be lost. This will incurs more delay to buffer the data packet during retransmission time and during selecting new next relay node resulting in a significant longer average end-to-end delay. On the other hand, as the sender's degree increase while using *GPSR-IFPE* the *IFPE* algorithm track and remove the outdated neighbours in the senders' *NLM* independent of sender's degree. As a consequence, this will decrease the number of outdated neighbours in the sender's *NLM*. Therefore, the outdated neighbouring node can be avoided to be selected as the routing node compared to the *GPSR*. And thus, during packet routing, the sender node selects an accurate neighbour for the next hop from its *NLM*. *GPSR-IFPE* achieves less 92.2% in average end-to-end delay due to the *IFPE* algorithm that increases the accurate information in a sender's *NLM* and avoids routing the data packet to inaccurate neighbours.

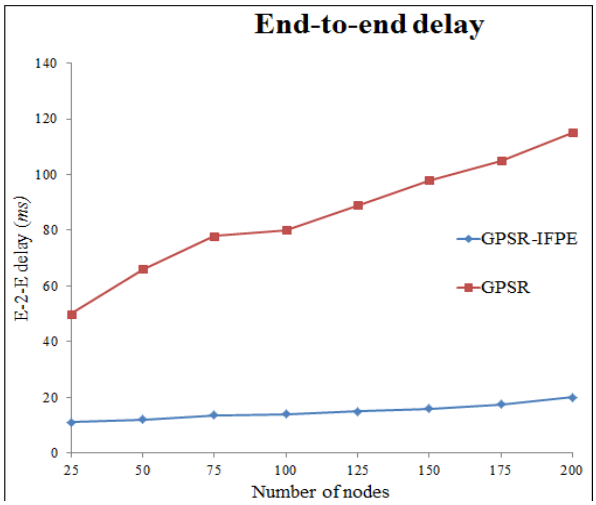

Fig. 12. average end-to-end delay in GPSR and GPSR-IFPE as a function of the number of nodes.

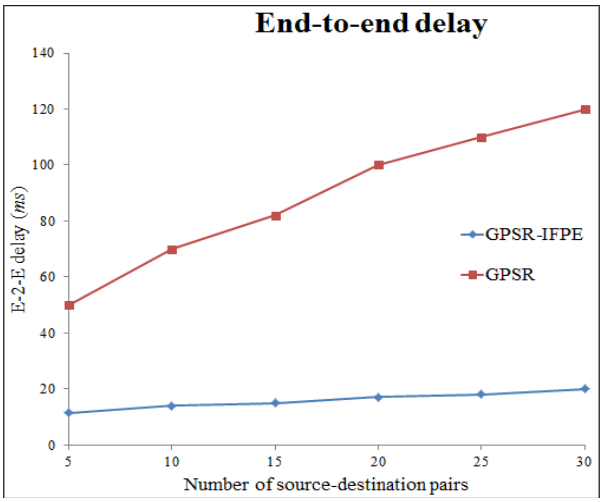

Fig. 13. average end-to-end delay in GPSR and GPSR-IFPE as a function of data traffics.

Fig. 13 shows the average end-to-end delay in *GPSR* and *GPSR-IFPE* protocols as a function of data traffics. For both protocols, as the number of flows increases, the average end-to-end delay increases also due to the increment in the number of packets in the network which caused more packets to be rerouted. *GPSR-IFPE* protocol achieves the lowest average end-to-end delay, because more packets are to be rerouted using different paths. While using *GPSR*, using outdated neighbours as next relay nodes will significantly increase the average end-to-end delay.

On the other hand, while using *GPSR-IFPE*, since the information of the neighbours in any nod's *NLM* is accurate, this result fewer ratio averages end-to-end delay compared with using *GPSR*.

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C. Nodes' Neighbours Matrix Credibility

Fig. 14 shows the Nodes' Neighbours Matrix Credibility *NMC* ratio in *GPSR* and *GPSR-IFPE* protocols as a function of node speed. As nodes mobility increase under using *GPSR* routing protocol, the number of outdated neighbors in a node's *NLM* matrix is increased and thus, the ratio *NMC* is increased too. The reason behind this increment that while nodes moving through the transmission range of a node will not send a beacon message because of using *FBPIT*, which bounded the *ELT* of entries for fixed interval time.

However, by using *GPSR-IFPE* protocol, the number of outdated neighbors in *NLM* matrix is much lower and the ratio *NMC* seems to be stable. The reason is referred to the fact that nodes using *GPSR-IFPE* protocol move the outdated entries of its neighbours relaying on residual link lifetime between the communicating nodes regardless the interval of *FBPIT*. As we can see, the *GPSR-IFPE* protocol shortens the *NMC* by 93.4 percent compared to *GPSR* routing protocol.

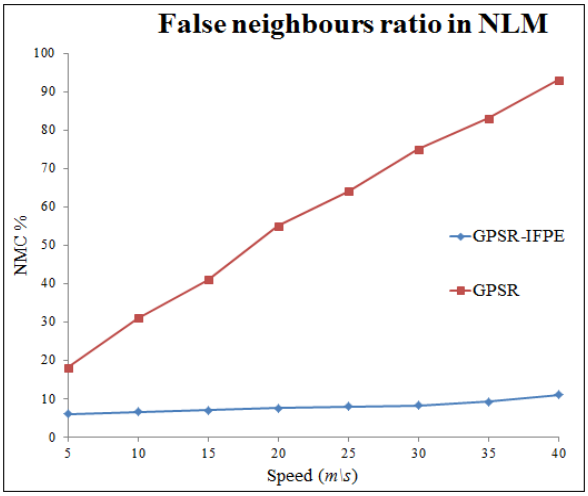

Fig. 14. Nodes' Neighbours Matrix Credibility NMC ratio in GPSR and GPSR-IFPE as a function of node speed.

Fig. 15 shows the Nodes' Neighbours Matrix Credibility *NMC* ratio in *GPSR* and *GPSR-IFPE* protocols as a function of the number of nodes. In both protocols as the number of nodes increases with the same network area the number of a node's degree increase too.

As shown in the figure, in *GPSR*, when the nodes' degree increases; the number of the detected outdated neighbours in nodes' *NLM* matrix increases too. This is because deleting the neighbour's entry is only based on the sending frequency of the HELLO packets.

However, the figure shows the effectiveness of *GPSR-IFPE* protocol; the number of outdated neighbors in nodes' *NLM* matrix is much lower and the ratio *NMC* seems to be stable. The reason is referred to the fact that nodes using *GPSR-IFPE* protocol remove the outdated entries of its neighbours more quickly relaying on residual link lifetime between the communicating nodes regardless the increment in a node's degree. As we can see, the *GPSR-IFPE* protocol shortens the *NMC* by 95.3 percent compared to *GPSR* routing protocol.

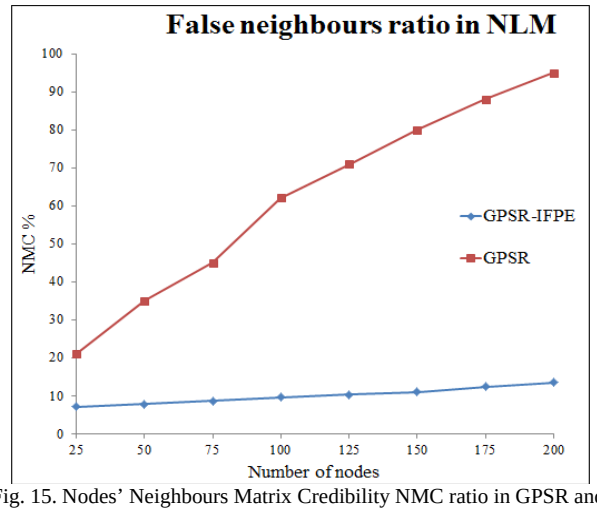

Fig. 15. Nodes' Neighbours Matrix Credibility NMC ratio in GPSR and GPSR-IFPE as a function of the number of nodes.

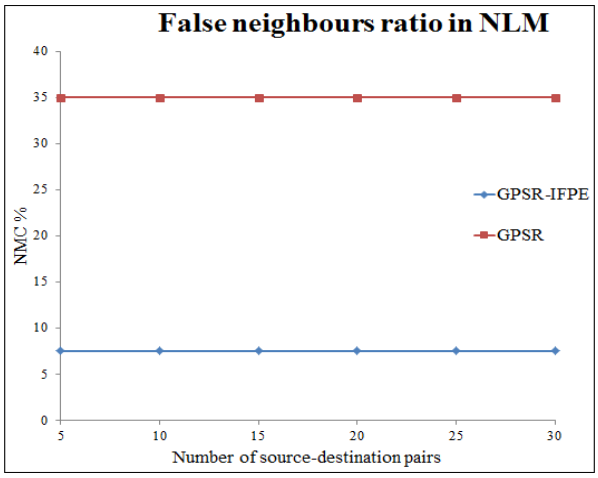

Fig. 16. Nodes' Neighbours Matrix Credibility NMC ratio in GPSR and GPSR-IFPE protocols as a function of data traffics.

Fig. 16 shows the Nodes' Neighbours Matrix Credibility *NMC* ratio in *GPSR* and *GPSR-IFPE* protocols as a function of data traffics for both protocols. As the number of data traffics increase, the number of outdated neighbors in a node's *NLM* matrix remains static since in both strategies the number of outdated neighbors in a node's *NLM* matrix is independent of the number of data traffics in the network. Furthermore, since in this scenario a fixed speed is used then *GPSR-IFPE* achieves the lowest ratio of *NMC*, the reason is referred to the fact that nodes using *GPSR-IFPE* protocol move the outdated entries of its neighbours relaying on residual link lifetime between the communicating nodes regardless the interval of *FBPIT*. On the other hand, the ratio of *NMC* in *GPSR* is the highest where entries are removed with fixed time related to *FBPIT*.

VII. Conclusions

In this paper, we first shortly mentioned the possible reasons that result inaccurate node's neighbors matrix in position-based routing. An inaccurate node's neighbours' matrix improved the risk of false routing decision make,

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which consider a major source of delay and packet loss. In the literature *ELT* is normally set to a multiple of the beacon interval sending time, which is not adaptive and impractical method. In this paper we showed through simulation results that when we adaptively optimized the *ELT* to be proportional to *RLT*, the risk of outdated neighbor entries is completely reduced. In every nod's neighbours' matrix, *RLT* is estimated based on the relative velocity (speed and direction) between both nodes. Basing on *RLT* a node runs *IFPE* to estimate the neighbour *ELT* and added it as another part of the entry for this neigbour. The *ELT* timer helps in determining the neighbour's existence in a node's transmission radius. By accomplish this, the neighbours' matrix can be consistence and more efficient, so that the success rate of the enhanced routing protocol is improved, through executing correct forwarding decisions.

To the best of our knowledge, all proposed works in the state of the art use a simple time outdated-based strategy with pre-specified fix time. Thus, if *ELT* is optimized as proposed in this work, the performance of position-based routing protocol could be easily improved significantly. From the result and analysis, we are now looking into further enhancement to the position-based routing protocols with an adaptive beaconing strategy.

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Comparative Analysis of Various National Cyber Security Strategies

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***Abstract*—The intrinsic vulnerabilities in the cyberspace and ever-escalating cyber-attacks tend to continuously threaten the national security, economy and daily life of citizens. More than fifty countries, around the world, have formulated their Cyber Security Strategies to address the grave concerns of national cyber security. A cyber security strategy is particularly aimed at securing the national cyberspace from malevolent cyber threat vectors, but owing to the varying threat landscape, considerable variations can be seen in the preventive, defensive and offensive measures and approaches adopted by each country.**

This research paper analyzes and compares National Cyber Security Strategies of twenty countries based on the documented legal, operational, technical and policy-related measures. The majority of the strategies have described the need of appointing an official body for leading the cyber security tasks at the national level and establishment of Computer Emergency Response Teams (CERT/CSIRT) to fight cyber-attacks targeting national cyberspace. However, disparity lies in the understanding of major key terms (particularly cyber security and cyberspace), characterization of the cyber threats, aims and description of cyber awareness and capacity building programs, legislative measures etc. Based on the comparison, the research specifies and recommends best practices for improving the state of national cyber security and resilience. The countries planning to develop or update their cyber security strategies can use this research study to their advantage.

Keywords-Cyber Security Strategy; Critical national infrastructure; Cyber-crimes; Cyberspace security; Incident response team.

I. INTRODUCTION

The Information and Communication Technology (ICT) has brought us great convenience in life and efficacy in governance. With the increasing reliance on ICT and sophistication of attack methods, the trend of cyber-attacks has changed from small-scale intrusion attempts and financial breaches to highly organized state-sponsored attacks. In view of the prominent business leaders and government officials, today cyber-attacks alone can cause more physical and financial loss than physical terrorism. [1]

The prominent cyber-attacks of the past especially the attacks on Estonia's internet infrastructure in 2007, the physical war between Georgia and Russia that turned into cyber war in 2008, and the attack on Iran's nuclear program via the Stuxnet worm in 2010 [2] made many countries realize that the omnipresence of ICT has made their national information infrastructure highly vulnerable to cyber-attacks. It also triggered the establishment of cyber-capability at federal level and preparation of a high-level plan of actions i.e National Cyber Security Strategy (NCSS). The Snowden's revelations of 2013, regarding National Security Agency (NSA) carrying out mass surveillance on the global Internet communications, also made many countries cautious about protecting their digital information and fundamental internet rights of their citizens.

This research study assesses National Cyber Security strategies of twenty countries, from different regions of the world, including Austria, Australia, Canada, the Czech Republic, Estonia, France, Finland, Germany, Iran, India, Israel, Japan, Malaysia, New Zealand, Netherlands, Saudi Arab, Spain, Turkey, UK, and USA. [3] The primary aim of the research is to analyze and compare the different cyber security trends, measures and approaches outlined in the respective publically available strategy documents. Based on this comparison, the later part of the research proposes recommendations/ best practices for lawmakers and executives to further improve the resilience of their national cyberspace. This comparative study will, therefore, be of great help to all the countries, whether designing their first cyber security strategy or updating the existing strategy documents.

II. SELECTION OF COUNTRIES

Since the study aims to highlight the best cyber security practices, a variety of countries that top the ITU's Cyber Security Ranking have been chosen for comparison. This set of the selected countries contains a fraction of each of the following:

A. Developed/ Advanced countries

This includes countries that lead the ITU's ranking with regard to cyber-preparedness [4], as seen in Table 1. The analysis of these strategies will provide a notion of advanced and secure cyberspace practices to be considered while formulating a cyber security strategy document.

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TABLE I. DEVELOPED COUNTRIES WITH HIGH CYBER SECURITY RANKING

Cyber Security Ranking	Country
1	USA
2	Canada
3	Australia
4	New Zealand
5	Estonia, Japan, UK, Germany
6	Austria, Israel, Netherlands
8	Finland
9	France, Spain
12	Czech Republic

The cyber security strategies of USA, UK, France, Netherlands, and Germany are particularly acknowledged worldwide for mentioning dual aspects of cyber security i.e. both offensive and defensive cyber security action plans [5]. Spain, Canada, Japan and Australia [6] have been selected because they have the highest ICT usage and cyber-crime rate in the world after US and Germany, and thus their analysis can reveal potentially secure approaches for combating cyber-crimes in the country. [7] Besides, the UK and US, the Czech Republic and Estonia are amongst the few countries that have updated their first strategy draft and, hence, it is necessary to look up to their strategies too, especially for the amendments in later versions. Netherlands has been chosen, because like the USA, it too has formulated two separate strategies; one for civil cyber security and the other for military cyber defence. Saudi Arab has lately strengthened its cyber defence and has, therefore, become the part of the research. [8] Finland and Israel, on the other hand, are considered the prime example of cyber excellence according to many security researchers. [9] This all reasons why the strategies of these countries have been selected for the study

B. Developing countries

This includes countries which have high cyber security ranking, according to ITU, as shown in Table 2. Cross comparison of such strategies will provide necessary information as to how the listed developing nations progressed with such a quick pace, in the cyber domain, leaving even many developed countries behind.

TABLE II. DEVELOPING COUNTRIES WITH HIGH CYBER SECURITY RANKING

Cyber Security Ranking	Country
3	Malaysia
5	India,
7	Turkey
19	Iran

The researchers regard Malaysia as the most cyber savvy country of Asia and, hence, it is included in the set of countries for research [10]. India and Iran have extremely high cyber-crime rates, so the analysis of their strategies will provide considerable directions for protecting the cyberspace against diverse threats and attacks.

III. COMPARISON METRICS

All the national cyber security strategies have the identical aim of protecting the cyberspace against adversaries and enhancing cyber resilience. However, the country's cyber threat landscape, socio-political conditions, security trends, traditions, the level of cyber awareness, etc, have brought significant variations in the cyber security approaches of the selected countries. [11] The following set of metrics has been developed to carry out the comparison of the aforementioned cyber security strategies.

- Timeline of development (the year when the Cyber Security Strategy or policy for a particular country was issued,
- Strategic objectives/ aims outlined in the strategy document,
- Understanding of major key terms i.e. cyberspace and cyber security,
- Level of prioritization assigned to national cyber security,
- Country's perception of cyber threats,
- Organizational Overview: i.e the leading organizations and public actors responsible for maintaining the state of cyber security at the federal level,
- Critical sectors and infrastructure listed in the strategy
- Incident response capabilities: i.e. whether Cyber Early Warning systems, Threat Information Sharing approaches, Computer Emergency Response Teams (CERTS) etc exist or not.
- Legal measures: covering evaluation and review mechanisms of the strategy.
- Capacity Building: includes the country's effort for Research and development (R&D), cyber workforce development, cyber awareness etc.
- Collaborations for cyber security (Inter-state, intra-state and international)

IV. COMPARISON BASED ON IDENTIFIED METRICS

The cyber security strategies exist in various forms and length varying from nine pages (Netherlands Cyber Security strategy of 2011) to ninety pages (Saudi Arabia's Cyber Security strategy of 2013). Most of the countries under study have developed separate strategies for national defence and cyber security, whereas few have added a portion of "cyber security" in the national security strategy or the defence strategy.

In most instances, the cyber security strategies have been published in the English language. The non-native English-speaking countries such as Czech Republic, Netherlands, Finland, Estonia, France, Germany, Turkey, and Spain have also published a draft in English simultaneously.

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Subsequent subsections will present more results of the comparison, based on the comparison metrics identified in Section III.

A. Development of the Cyber Security Strategy

The development of cyber security strategies gradually gained momentum after 2008 when the trend of simple cyber-attacks shifted to massive targeted state-sponsored attacks. Table 3 below gives a timeline of NCSS of various national cyber security strategies that have been selected for the research study. With the exception of Iran, Israel and Malaysia, all the countries have published their strategies online. The data for these three countries have been extracted from the public documents pertaining to the cyber security approaches in the country.

TABLE III. TIMELINE OF CYBER SECURITY STRATEGIES

Countries	Year Strategy/ Policy issued
Australia	Strategy 2009, Revised strategy expected in 2015
Austria	Strategy 2013
Canada	Strategy 2010, Action Plan for Strategy (2013)
Czech Republic	Strategy 2011, 2015
Estonia	Strategy 2008, 2014
Finland	Strategy 2013
France	Strategy 2011
Germany	Strategy 2011
India	Policy 2013
Iran	NCSS not public
Israel	Official NCSS not published
Japan	Strategy 2013
Malaysia	Policy 2006 (document not public), NCSS expected in 2017
Netherlands	Strategy 2011, 2013
New Zealand	Strategy 2011
Saudia Arab	Strategy 2013
Spain	Strategy 2013
Turkey	Strategy 2013
UK	Strategy 2009, 2011
USA	Strategy 2003, Strategy Review (2009), Policy 2011, Strategy for critical infrastructure (2014), Dept. of Defence's strategy 2015.

The timeline infers that majority of the countries published their cyber security strategy in 2011. The United States of America, on the other hand, published the first strategy draft in 2003, when cyber-attacks were not very common.

However, the continuously changing spectrum of cyber threats has made it imperative to update the cyber security strategy to encompass emerging threats and relevant countermeasures. Countries particularly the UK, USA, Netherlands, Czech Republic and Estonia have consequently published the subsequent versions of their strategy as well, with USA reviewing and updating their documents most frequently.

B. Strategic Objectives outlined in NCSS

NCSS basically defines the vision of any country for addressing the cyber security challenges at the national level. Since all strategies are directed towards the ultimate goal of safeguarding the national cyberspace, they share many common themes and concerns. Except for Germany, which lists down some priority areas as the objectives, all other countries clearly states their strategic objectives in the document. The common objectives found in almost all NCSS are: [12]

- To maintain a safe and resilient cyberspace,
- To secure critical national cyber assets and infrastructures,
- To define a cyber-security regulatory, legislative and assurance framework,
- To raise cyber awareness amongst citizens, government officials, IT professionals etc,
- To develop cyber security incident detection and response capabilities e.g. Cyber-Security Incident Response Team (CSIRT) etc,
- To develop indigenous cyber-security technology,
- To respect fundamental rights of netizens,
- To promote public-private co-operation for enhancing the cyberspace security,
- To stimulate international co-operation mainly with the neighbouring and regional countries.

Beside the common ones, few strategies have also proposed objectives that are only specific to their country. For instance, France desires to become a world leader in cyber security domain in near future. Also, Japan desires for agile adaptation of evolving cyber threats and introduction of global outreach programs for cyber security, etc.

The thorough study of the selected strategies also brings forward the fact, that with the passage of time, the scope of cyber security strategies is shifting from merely securing citizens or governments against cyber-attacks to securing the whole information society in general.

C. Diverge Understanding of Key Terms

Cyber Security is quite a vast domain. Since there are no globally harmonized definitions of cyber security key terms, almost every country has provided its own definition in the strategy document. This sub-section will compare the definitions of cyber security and cyberspace as defined in the respective strategies.

1) Cyberspace: The comparison of selected strategies indicates that for most of the countries, cyberspace is perceived to be a complete network of all virtual and physical ICT devices that can be the target of evil cyber actors. However, for countries like New Zealand, Australia,

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Germany, Spain and Canada, the cyberspace only refers to the Internet and the pertinent ICT devices.

Furthermore, Estonia and Netherland have only implicitly defined cyberspace in their cyber security strategies and have not provided complete definitions. Also, Finland, being an exception, has used the term "cyber domain" instead of cyberspace in their strategy. Table 4 summarizes the results for this sub-section.

TABLE IV. CYBERSPACE DEFINED BY VARIOUS COUNTRIES

#	Comparator	Countries
1	Cyberspace includes all virtual and physical ICT devices	USA, UK, France, India, Saudi Arab and Turkey
2	Cyberspace only refers to "internet" and internet connected ICT devices	New Zealand, Australia, Germany, Spain and Canada
3	No clear definition of cyber security is provided	Estonia and Netherland
4	Term "Cyber domain" has been used instead of cyberspace	Finland

2) Cyber Security: Most of the strategies under study have defined "cyber security" as combating every cyber threat within the cyberspace. However, Austria and Finland limit it only to the protection of digital information or critical infrastructure. These varying perceptions lead to multi-faceted approaches for addressing and mitigating cyber-attacks.

In the strategy document, where Australia, France, Germany, Netherland, Saudi Arab and New Zealand have clearly mentioned their definition of cyber security, UK and Canada have used descriptive texts to define their concept of cybersecurity. Moreover, the Czech Republic and Japan have not explicitly defined "cyber security" anywhere in the strategy. [13] The results have been summarized in Table 5.

TABLE V. CYBER SECURITY DEFINED BY VARIOUS COUNTRIES

#	Comparator	Countries
1	Clear definition of cyber security is given in document	Australia, France, Germany, Netherland, New Zealand, Saudi Arab, Turkey
2	Detailed description is provided to define "cyber security"	Canada, UK
3	No definition of cyber security provided	Czech Republic, Japan

D. Level of prioritization assigned to cyber security

In the last few years, besides terrorism, economic downturn, natural hazards, etc, cyber-attacks, cyber espionage and cyber terrorism have also become a global menace. The comparative analysis reveals that countries have now realized the importance of cyber security and, therefore, regard it as one of the top-tier national security issues. Countries especially USA, UK, Japan, Germany, Australia and France that have inflated rates of cybercrimes, have allocated significantly greater resources to cyber security measures than other countries under study. According to the publically available data, the UK spends £650m annually, India $500 million, France $1.2 billion, Canada $6 billion, and USA with the highest annual cyber security spending in the world amounting up to 10 billion dollars. [14] The facts indicates that despite same prioritization is assigned to cyber security in various documents, extensive variation lies in the budget allocated to national cyber security initiatives. [15]

E. Characterization of Cyber Security Threats

For most of the countries, especially Canada, USA, UK, Germany, Netherlands etc the potential risks and threats posed to the cyberspace revolve around organized cybercrimes, state-sponsored attacks, cyber terrorism, unauthorized access to and interception of digital information, electronic forgery, vandalism and extortion etc. For Germany and Netherlands, natural hazards and hardware/software failures too are regarded as the cyber threats. [16]

In the cyber security strategies, there also exist some offenses that varies in terms of severity of the crime in different countries. Since Germany view cyber-attack as the attack on IT systems that compromises confidentiality, availability and integrity of the information systems, USA considers it as an attack on the digital information, ICT devices and cyber networks. Hence, where probing is considered as a cybercrime in Germany, it is not an offense in USA. [17] Thus the varying perception of cyber security and the cyber threat landscape makes it difficult to adopt a holistic global approach to cyber threats and adversary.

Apart from the traditional cyber-attacks, few countries have also taken account of emerging cyber risks in their strategies e.g. France, Japan and India have considered the risks of Cloud Computing, Japan mentions the need of addressing the security of Internet Protocol IPv6 and e-appliances attached to smart grids etc, in the document. Few countries such as Estonia, USA, Germany and Netherlands have also referred to cyber warfare in their documents. However, Finland and France have not defined any cyber threat topology explicitly in the strategy.

F. Critical Sectors/ Infrastructures

Critical infrastructure is basically considered to be any physical or digital asset, which if compromised can pose a debilitating effect on the economy, security and prosperity of a nation. In the cyber domain, the criticality of an infrastructure is defined by the services and core values that it provides and the digital information that it processes, stores and transmits.

The choice of critical sectors or infrastructure by any country is highly impacted by the country-specific peculiarities and traditions, cyber threat perception, socio-political factors, and geographical conditions. It is for this reason that a particular subsectors/ assets have been classified so differently by two countries i.e. smart electricity grids

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might be a vulnerable asset for the developed states but not for many developing nations.

The critical sectors have been clearly listed by UK, USA, Australia, Canada, Netherlands, and Turkey. However, Malaysia despite lacking a dedicated cyber security strategy and a comprehensive Critical Information Protection Policy still outlines vulnerable sectors in the federal documents. Austria, however, has not provided any detail about their critical resources. [18] Currently, following sectors are considered critical for most of the countries.

- Telecommunication and ICT,
- Banking and Finance,
- Government and the pertinent e-services,
- Electricity,
- Water Supply,
- Health Services i.e. hospitals,
- Transportation (especially air, rail and road),
- Emergency and Rescue Services,
- National Security services i.e. police, armed forced etc

The oil and gas sector, judiciary, chemical sector, critical manufacturing sector, dams, food and agriculture sectors have also been regarded as critical sectors by few countries. However, the list of critical sectors for any country is not conclusive, since digitization of ICT infrastructures, the inherent vulnerabilities, the increasing sophistication of cyber-attacks etc. are continuously adding new sectors and infrastructure to this list.

G. Organizational Overview- Lead responsible Authority

This subsection compares the officially recognized organizations or authorities of the selected countries that are responsible for implementing the cyber security strategy, protecting the critical assets and maintaining the state of cyber security at the national level.

The comparative analysis reveals that the majority of the countries have established inter-departmental cyber security response capabilities i.e. they have distributed the task of cyber security amongst multiple existing organizations working under various governmental departments. The establishment of these organizations within the government is greatly influenced by cyber threat perception, resource allocation, defence tradition etc.

France and Estonia, however, have created new coordinating bodies, which centrally deals with cyber threats and attacks. Table 6 gives a general overview of the leading authorities responsible for cyber security tasks in the countries under study. [19]

TABLE VI. LEAD RESPONSIBLE AUTHORITIES

#	Responsible Authority	Countries
1	Head of the state	USA
2	Cabinet office	Australia, Japan, UK
3	Ministry (Information Technology, Interior, Law, Defence etc.)	Canada, Germany, India, Czech Republic, Netherlands, New Zealand, Saudi Arab, Malaysia, Turkey, Iran, Austria, Spain
4	New coordinating bodies	France, Estonia

As observed, on the whole, there is very little consistency across various comparators in terms of the departments entrusted with the task of national cyber security.

H. Technical Measures: (Threat Information Sharing/ Early Warning Approaches.)

For a country to effectively deter targeted cyber threats and incidents, it is essential to have technical teams that efficiently disseminate threat information to the concerned authorities and provide cyber protection and resilience capabilities. Various forms of such teams include Computer Emergency Response Teams (CERTs), Computer Security Incident Response Team (CSIRT) and Information Sharing and Analysis Centers (ISAC).

The cross comparison of the selected NCSS reveals that all the countries possess their own national CERT/ CSIRT for effectively responding to cyber-attacks. However, the missions and efficiency of these entities greatly vary for one another. Table 7 below provides a timeline of the establishment of CERT/ CSIRTS in the countries under study. [20]

TABLE VII. EARLY WARNING APPROACHES FOR VARIOUS COUNTRIES

Countries	CERT established
Australia	2010
Austria	2008
Canada	2003
Czech Republic	2011
Estonia	2006
Finland	2014
France	2008
Germany	2012
India	2004
Israel	2014
Japan	1996
Malaysia	1997
Netherlands	2012
New Zealand	2011
Saudia Arab	2006
Spain	2008
Turkey	2007
UK	2014
USA	2003

Few countries have also established coordinating bodies along with CERT/ CSIRTS for information threat sharing. For example Integrated Government of Canada Response Systems by Canada, Cyber Security Strategy Head quarter by Japan, etc.

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I. Legal Measures:

To ensure that all public and private entities can handle cybersecurity challenges, it is necessary to establish an appropriate policy framework to frequently evaluate the progress of the proposed objectives of the strategy and revise the strategy accordingly.

The research reveals that except for Spain, most countries within the scope of study have mentioned review and evaluation processes for the strategy in the documents. Since, Malaysia has not formulated the complete strategy yet, it, therefore, lacks annual cyber security audits and policy reviews too. Countries such as Austria, Estonia and Germany have even specified the actors to be involved in reviewing mechanisms. However, in all instances, the details of review mechanisms have been provided as a separate act or in implementation scheme.

Several strategies have also mentioned the frequency of the review cycle i.e. yearly for Netherlands and Slovakia and biannual for Austria and UK. [21]. While USA, UK, Estonia and few other countries update their cyber security strategy very frequently, there are countries that have not even updated their initial cyber security strategies once.

J. Cyber Security Capacity Building

All cyber security strategies mention the need of creating cyber defensive and preventive capabilities to better defend the national cyberspace. This subsection throws light on various cyber security capacity building initiatives e.g. training, awareness, R&D initiatives etc, as documented in the selected strategies.

1) Manpower Development and Cyber Awareness Programs: All cyber security strategies emphasize the need of raising cyber awareness in general public especially businessmen, IT professionals, government officials and lawmakers. But countries especially, Australia, Spain, Japan and the UK pay special attention to the cyber training of children and parents too. [22]

Countries particularly UK, India and Malaysia have mentioned the usage of social media for launching widespread awareness campaigns. However, Netherlands and Turkey emphasize the need of teaching cyber security at all academic levels and have thus suggested making it a part of academic curriculum.

All the nations under study, except for the Czech Republic, have defined nation-wide cyber-security outreach programs for their citizens, where they provide cyber security tools and practical education. The most notable programs amongst them are Stay Safe Online campaign of Australia, Malaysia's "Cyber Safe" Program, "Get Safe Online" program of UK, and organization of "Cyber Security Month" annually by Austria, UK, and US. [23]

The study also reveals Japan's desire for establishing various cyber security support services for the capacity building. Moreover, countries especially UK, Netherlands, India, Saudia Arab, Malaysia, and Turkey emphasize the need of commercial security certifications/ trainings for professionals and experts in their NCSS. [24]

2) Research and Development: To prevent inherent vulnerabilities of the ICT devices from being exploited by adversaries, it is required to lay stress on the development of local security products, thereby enhancing cyberspace security. The comparative study shows that except for Australia, Saudia Arab, Czech Republic, UK and Finland, all other countries have officially recognized entities for promoting R&D work at the national level. The tasks of the R&D divisions as mentioned in the various strategies are to sponsor academic and industrial projects related to cyber security, develop indigenous cyber security products, promote security standards and best practices at the national level, etc.

K. Cooperation

Cybersecurity requires multi-stakeholder approach for effectively tackling cyber issues and increasing cyber resilience. Because of the global nature of cyberspace, apart from intra-nation cooperation (public, private sectors, ISP's etc), intra-state and international collaboration are also required. [25]

1) Public-Private Partnership (PPP): Public-Private Collaboration is necessary since private sector owns most of the internet infrastructure. Hence, the public and private sectors should effectively cooperate to defend the cyberspace. Research shows that it has been introduced as a concept in NCSS of Canada, Australia, UK, Saudi Arab and Netherlands, and as a part of the action plan in France's NCSS.

However, except for Iran, Czech Republic, Finland and Spain, all the countries under the study, have defined Public Private Partnership plans in the strategy with an aim to address the issue of cyber security at the national level.

2) Cooperating with ISPs: The strategies of countries like USA, UK, Japan, Saudi Arab and Australia emphasize greatly on the need of government's partnership with Internet service and telecom providers for better security of national cyberspace from internal and external cyber preparators. Others do not explicitly mention this in the strategy.

3) International Collaboration: Since it is impossible to guarantee security of the national cyberspace in an insecure global cyber environment, almost all the strategies have laid stressed on the need of international collaboration in the domain of cyber security, especially with neighboring and regional countries. Where other strategies have merely proposed it as an objective and have not provided details, cyber security strategies of USA, UK, Germany and Australia also mentions action plan to improve global cooperation.

V. Recommendations

With the cyber preparators gaining strength day by day, cyber-attacks are continuously evolving at a faster pace. No nation can, therefore, stay safe from cyber-attacks. Following recommendations if adhered, while formulating or revising the

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cyber security strategy can help mitigate cyber risks to the national cyberspace. [26]

- Clearly define the scope, objectives and definitions of major key terms in the document in accordance with the country's actual threat landscape.
- Do not confine the strategy only to the protection of critical assets, rather focus on securing the entire national cyberspace and defending fundamental rights of internet users.
- Redefine the words "critical infrastructures" in the strategy because the existing definition i.e. "infrastructures that adversely affects the national economy and security when compromise", leaves many critical computer networks out of the scope of critical infrastructures.
- Attempt to focus on the protection of cyberspace from new threat vectors e.g. smartphones, cloud computing, big data etc in the document.
- Incorporate the principle of agility by subjecting the strategy to regular reviews, and input from industry to keep pace with the technological advances and increasing cyber risk sophistication.
- Include input from all national stakeholders; government, military, telecom providers, financial institutions, judiciary, civil society, religious leaders, cyber security experts etc, on domestic cyber security strategy or action plans.
- Support the strategy by articulating a comprehensive plan of cyber actions, with clearly defined stakeholders, authorities, accountabilities, milestones; investments, outcomes etc,
- Emphasize on the need of reforming national legal framework, in the strategy, to effectively deal with cyber-criminals and offenders,
- Ensure that there are effective technological controls for people, management, facilities, operations, etc in place, at all levels,
- Lay stress on the need of establishing information sharing framework to effectively share information regarding security incidents and breaches between the government and private sector.
- In the strategy, clearly define tasks and responsibilities of the CERTS/ CSIRTS from disseminating information about security advisories and cyber breaches to raising cyber awareness and forensically responding to cyber incidents, etc.
- Recommend various educational and training programs, cyber security toolkit etc, in the strategy, for netizen's self-training and raising cyber awareness in the country,
- Encourage the development and promotion of indigenous security services and products
- Give advice on reinforcing private-public partnership to ensure continued cyber resilience of the national cyberspace.
- Propose acceptable cyber norms in the strategy document to increase international collaboration and prevent cyber warfare in the future.

VI. Conclusion

In the recent years, cyber security has gained more attention than the issue of national physical security. Countries around the world are, therefore, formulating cyber security strategies to address this grave issue. Almost all documented strategies, selected for the strategy, have mentioned the need of establishing incident prevention and response capabilities at the national level, raising cyber awareness in general public, and promoting public-private partnership for better security of the cyberspace, etc. However, the majority of the countries have practically tried less to achieve the stated objectives.

Despite similar aims and objectives, the research has unveiled numerous differences in the scope and approach of the twenty strategies selected for the study. For instance, the establishment of CERT has been mentioned in all the strategies, but the tasks assigned to it varies from country to country. Similarly, all strategies urge the need of running various cyber awareness programs, but the approach of every country is different from the other.

From the research, it is obvious that the strategies of UK, USA and Germany particularly are better than the rest in terms of development and enforcement of action plans. Despite stating defensive missions in the strategy, they have also emphasized on utilizing their cyber capabilities to defend valuable assets offensively, and this gives them the edge over the other countries.

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Performance Evaluation of Slant Transform based Gray Image Watermarking against Common Geometric Attacks

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***Abstract*- Performance of slant transform based watermarking technique is evaluated against cropping, rotation and common geometric attacks in this paper. Gray cover image is transformed using lifting wavelet transform and singular value decomposition while watermark image is transformed using slant transform. Cover image is watermarked by replacing singular values of original image by that of slant transformed watermark image. Proposed method is tested with different scaling factor ranging from 0.01 to 0.1 and found to be robust against cropping, rotation and common geometric attacks. This method easily detects and extracts watermark with great accuracy. Method is semi blind and realized in MATLAB.**

Keywords— slant transform, geometric attacks, lifting wavelet transform, robustness

I. INTRODUCTION

With the swift sprouting of internet and information technology, the information exchange process is being carried out in the form of digital text, image, audio and video. Information in digital format can be modified without loss in quality and content and can be efficiently distributed with a great ease. The ease with which digital content can be exchanged over the Internet has created copyright infringement issues and has caused major concerns to digital content owner who produces those digital content [1]. This leads to a serious requirement of a robust technique that can address the security of those information such that the authenticity, availability, confidentiality, identity and integrity of the information is maintained.

Digital image watermarking is one of the techniques for solving copyright and ownership issues. In this a pattern of bits are inserted into a digital image, audio, video or text file that identifies the file's copyright information [1]. Traditionally, cryptography was used for authentication. Cryptography provides security only by encryption and decryption. So there is no protection after decryption. In addition, cryptography is only about protecting the content of the messages while watermarking has more applications than that. [2].

Watermarks can be embedded using spatial domain methods or transform domain methods .Spatial domain methods have less complexity because no transform is used, but these are not robust against attacks. Transform domain techniques are highly robust in comparison to spatial domain watermarking techniques. This happens because the watermarked image is inversely transformed and watermark is irregularly over the image. It becomes difficult for the attackers to read or modify the image [3].

Robustness, transparency (invisibility), payload size and security are the four essential factors to determine the quality of watermarking scheme [4]. Robustness means that the embedded watermarks cannot be removed by intentional or unintentional attacks. Although robustness can be obtained based on significant modifications to the host data, such modifications are noticeable and thus do not satisfy the requirement of transparency. Thus, there is tradeoff between robustness and transparency. On increasing robustness, transparency decreases and vice versa [4].

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So, new algorithm to embed watermark in digital data is to be developed which provide strong robustness and at the same time good transparency.

The wavelet transform is one type of transform domain technique. Wavelet based transforms gained popularity because of the property of multi-resolution analysis that it provides. However, traditional wavelet function uses a simple relationship among all multi-resolution analyses with the same scaling function. So new scheme of wavelet called lifting wavelet transform (LWT) was introduced. It has certain benefits like it requires less time, less storage space, chooses detail coefficients rather than approximation coefficients and the transform coefficients from LWT are integers, overcoming the weakness of quantizing errors from the traditional wavelet transform [5] [6] .

In this paper, the fusion of Slant transform, LWT and Singular value decomposition (SVD) approaches is proposed. This paper is organized as follows: Section II discusses a brief review of some of the works available. Section III presents the proposed method. Section IV throws light on the experimental results whereas the summary of results and the conclusion is presented in Section V.

II. Related works

Very few works has been done with slant transform. First work was carried out by Xunzhan Zhu, Anthony T.S. Ho [4]. They transformed watermark image using slant transform. Such transformed image was used to replace the middle band frequencies of cover image. This method was found to be robust against various geometric attacks. Similarly, Anthony T.S. Ho, Xunzhan Zhu and Jun Shen [5] also used slant transform to embed watermark. They also transformed watermark image through slant transform then resultant image was used to replace the middle frequencies of cover image. This method was found robust against various geometric attacks. Alimohammad Latif [6] also used slant transform to watermark cover image. Author first converted cover image into blocks. These blocks were passed through slant transform. Watermark was inserted into middle band frequencies using correlation. This method was found to transparent up to 33.956 dB. The method survived various geometric attacks. Amy Tun and Yadana Thein [7] used hybrid transform. They used discrete cosine transform in addition with LWT. They embedded watermark using pseudo random noise (PN) sequence. The method was blind and spread spectrum based. Their watermarked image had transparency (Peak Signal to noise ratio (PSNR) value) up to 47.3425 dB.

C. N. Sujatha and P. Satyanarayana [8] applied DCT, DWT and SVD for color image watermarking. They embedded watermark image in singular values of DCT and DWT transformed RGB image. Their method was non blind and needs watermark and cover image during extraction as well. Prescribed method had poor robustness though had good imperceptibility.

Ghazali Bin Sulong and et al [9] used hybrid domain to watermark color images. They converted RGB color space into YCbCr color space before embedding watermark. They used DWT and canny edge detection method. The prescribed method does not have good robustness as imperceptibility.

Hongshou Yan and Weimin Yang [10] used Hadamardtransform (HT) in association with DWT to embed watermark. They embedded binary watermark image into blue or green component of DWT and HT transformed cover image. Their prescribed method was robust to the common signal processing techniques.

Anubhav Kumar [11] used DWT to embed watermark in RGB image. The method was non blind and robust to common geometric attacks like noise, rotation, brightness and contrast manipulation.

III. Watermarking Using Slant transform

This section details the proposed semi-blind watermarking scheme for copyright protection of digital images. The following subsections present the steps involved in the watermark embedding and extraction processes along with a brief description about the Slant transform, DWT and SVD

A. Slant transform

Slant transform is derived from saw tooth waveforms. A slant transform matrix has a constant basis vector corresponding to zero sequency and slant basis vector basis vectors monotonically decreases with sequency in constant step from maximum to minimum. The matrix has sequency property and high energy compaction property [12]. The lowest order of slant matrix is 2 and 2 X 2 matrix is identical to Hadamard matrix. Two dimensional slant transform pair is given by

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$$[F(u,v)] = S_M [f(r,c)] \, Sn^T$$
$$[f(r,c)] = S_M T [F(u,v)] \, S_N \quad (1)$$

The Slant transform is a member of the orthogonal transforms. It has a constant function for the first row, and has a second row which is a slant function of the column index [4].

B. Lifting wavelet transform (LWT)

Lifting Wavelet Transform based on the traditional wavelet is introduced by Wim Sweldens, using a simple relationship among all multi-resolution analyses with the same scaling function. [12].

The principle of LWT is to break up the high-pass and the low -pass wavelet filter into a sequence of smaller filters that in turn can be converted into a sequence of alternating upper and lower triangular matrices and a diagonal matrix with constants. The factorization is obtained by using an extension of the Euclidean algorithm. The resulting formulation can be implemented by means of banded matrix multiplications.

C. SVD

Singular values of the image gives very good stability. When a small value is added, it does not result too much variation. Hence Singular Value decomposition (SVD) in linear algebra is used to solve many mathematical problems [13].

Every real matrix A can be decomposed into product of three matrices

$$A = U \sum V^T \quad (2)$$

Where U and V are orthogonal matrices such that, UUT =1 and VVT = 1and $\sum$ is summation of diagonal entries λ 1, λ 2·gives the singular vectors of A. These diagonal entries are called as Singular Values of A and the decomposition is called as ' Singular Value Decomposition'. Singular Values specifies the luminance of an image layer while corresponding pair of singular vectors specifies the geometry of the image layer [13].

Detail watermarking process and extraction processes are as follows:

A. watermark embedding process

1. Read gray cover image C
2. Apply 2D-LWT to C. Select HH sub band. Apply 2D-LWT three times further.
3. Obtain singular values S_c of HH3 using SVD transform
4. Read watermark image W
5. Divide W into nonoverlapping blocks and apply slant transform to get W_s
6. Obtain singular values S_w of W_s using SVD transform
7. Embed watermark by modifying Sc using following equation

$$S_{cNEW} = \alpha * Sw \quad (3)$$

8. Reconstruct HH3 using reverse SVD function
9. Construct watermarked image W' using inverse 2D-LWT function 4 times

B. watermark extraction process

1. Read watermarked image W'
2. Apply 2D-LWT to W'. Select HH sub band. Apply 2D-LWT further three times.
3. Obtain singular values Sc' of HH3 using SVD transform of watermarked image
4. Read watermark image W
5. Divide W into nonoverlapping blocks and apply slant transform to get W_s

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6. Obtain values U_w and V_w of W_s using SVD transform
7. Retrieve watermark bits S_r using following equation

$$S_r = Sc'/\alpha \quad (4)$$

8. Reconstruct recovered watermark image using U_w, S_r and V_w reverse SVD and inverse slant transform.

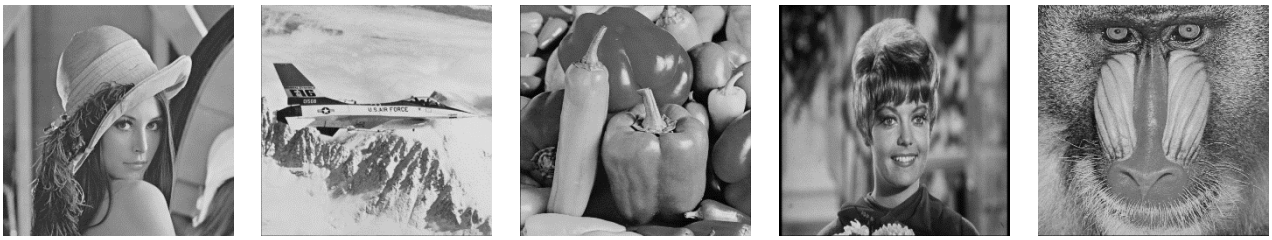
IV. Experimental Results

Above discussed algorithms are implemented in Matlab. Five test images of size 512 *512 and a watermark of size 32*32 as shown in figure 1 below are used. Robustness are conducted with varying values of scaling factor α. It is tested using normalized correlation (NC).

NC is calculated using equation (5):

$$NC = \frac{\sum\sum[W(u,v)W'(u,v)]}{\sum\sum[W(u,v)]^2} \quad (5)$$

Here W(u, v) is original 2mage and the watermarked image is W'(u, v). N is the number of pixels. Similarly, W is original watermark while W' is recovered watermark.



Lena F-16 Flight Pepper Zelda Mandrill

Watermark Image

Fig.1: Cover images and watermark images

A. *Robustness against general geometric attacks*

To evaluate the response of the watermarking scheme to general geometric, watermarked images were passed through different attacks like histogram equalization, median filtering, sharpening, making negative and blurring it. Figure 2 shows the common geometric attacked watermarked images under scaling factor 0.7. Table II shows the extracted watermarks from watermarked images after common geometric attacks under different scaling factors. Their corresponding normalized correlation is shown in table I.

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Histogram Equalized Lena | Median Filtered F-16 Flight | Sharpened Pepper | Negative Zelda | Blurred Mandrill

Fig.2:Different attacks on different watermarked images at α=0.07

Table I. NC of original and extracted watermarks on normal geometric attacks

Image	α	Histogram Equalization	Normal Blur	Median Filtering	Negative	Sharpening
Lena	0.03	0.9455	0.9578	0.9154	0.9578	0.9454
	0.07	0.9692	0.9919	0.9138	0.9919	0.9625
	0.1	0.9702	0.9908	0.9260	0.9908	0.9585
Zelda	0.03	0.9705	0.9951	0.9137	0.9951	0.9694
	0.07	0.9780	0.9878	0.9406	0.9878	0.9537
	0.1	0.9752	0.9862	0.9460	0.9862	0.9531
Pepper	0.03	0.9474	0.9631	0.8461	0.9631	0.9568
	0.07	0.9739	0.9926	0.8986	0.9926	0.9646
	0.1	0.9771	0.9892	0.9209	0.9892	0.9577
F-16	0.03	0.9370	0.9640	0.8680	0.9640	0.9575
	0.07	0.9492	0.9909	0.9109	0.9909	0.9617
	0.1	0.9496	0.9881	0.9253	0.9881	0.9562
Mandrill	0.03	0.9302	0.9415	0.8828	0.9415	0.9398
	0.07	0.9510	0.9811	0.8572	0.9811	0.9635
	0.1	0.9696	0.9903	0.8625	0.9903	0.9630

Table II. Extracted watermarks on normal geometric attacks

Image	α	Histogram Equalization	Normal Blur	Median Filtering	Negative	Sharpening
Lena	0.03					
	0.07					
	0.1					
Zelda	0.03					
	0.07					
	0.1					

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Pepper	0.03					
	0.07					
	0.1					
F-16	0.03					
	0.07					
	0.1					
Mandrill	0.03					
	0.07					
	0.1					

From these observations, it is clear that method is strong enough to detect and extract watermark image common geometric attacks.

B. Robustness against general cropping attacks

To evaluate the response of the watermarking scheme to cropping attack, watermarked images were trimmed at different places under different scaling factors like center, right, left, top and bottom. Figure 3 shows the trimmed watermarked images under scaling factor 0.7. Table IV shows the extracted watermarks from watermarked images after cropping attack under different scaling factors. Their corresponding normalized correlation is shown in table III.

Trim at center Trim at bottom Trim at top Trim at left Trim at right

Fig.3 Various cropping attacks on Watermarked Mandrill image at α=0.07

Table III. NC values on cropping attacks

Image	α	Cropping center	Cropping DOWN	Cropping UP	Cropping LEFT	Cropping RIGHT
Lena	0.03	0.9445	0.9496	0.9579	0.9579	0.9587
	0.07	0.9669	0.9930	0.9926	0.9926	0.9920
	0.1	0.9713	0.9924	0.9902	0.9901	0.9908
Zelda	0.03	0.9508	0.9939	0.9938	0.9951	0.9942
	0.07	0.9724	0.9847	0.9838	0.9873	0.9871

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	0.1	0.9734	0.9815	0.9840	0.9860	0.9861
Pepper	0.03	0.9489	0.9760	0.9577	0.9678	0.9709
	0.07	0.9689	0.9900	0.9897	0.9925	0.9900
	0.1	0.9807	0.9843	0.9948	0.9884	0.9865
F-16	0.03	0.9121	0.9736	0.9600	0.9629	0.9644
	0.07	0.9437	0.9899	0.9910	0.9905	0.9905
	0.1	0.9486	0.9868	0.9876	0.9872	0.9874
Mandrill	0.03	0.9457	0.9485	0.9274	0.9396	0.9384
	0.07	0.9838	0.9855	0.9534	0.9816	0.9733
	0.1	0.9921	0.9910	0.9770	0.9934	0.9863

Table IV. Extracted watermarks on cropping attacks

Image	α	Cropping center	Cropping DOWN	Cropping UP	Cropping LEFT	Cropping RIGHT
Lena	0.03					
	0.07					
	0.1					
Zelda	0.03					
	0.07					
	0.1					
Pepper	0.03					
	0.07					
	0.1					
F-16	0.03					
	0.07					
	0.1					
Mandrill	0.03					
	0.07					
	0.1					

From these observations, it is clear that method is strong enough to detect and extract watermark image cropped images.

C. Robustness against general rotation attacks

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To evaluate the response of the watermarking scheme to rotation attack, watermarked images were rotated at different angles under different scaling factors like 2 degree, 5 degree, 45 degree, 90 degree and 180 degree. Figure 4 shows the rotated watermarked images under scaling factor 0.7. Table VI shows the extracted watermarks from watermarked images after rotation attack under different scaling factors. Their corresponding normalized correlation is shown in table V.

Rotate 2^0 Rotate 5^0 Rotate 45^0 Rotate 90^0 Rotate 180^0

Fig.4 Various rotation attacks on Watermarked lena image at α=0.07

Table V. NC values on rotation attacks

Image	α	Rotation 2 ^{0}	Rotation 5 ^{0}	Rotation 45 ^{0}	Rotation 90 ^{0}	Rotation 180 ^{0}
Lena	0.03	0.8444	0.8590	0.8496	0.9578	0.9578
	0.07	0.8672	0.8684	0.8487	0.9919	0.9919
	0.1	0.8920	0.8769	0.8420	0.9908	0.9908
Zelda	0.03	0.9018	0.8470	0.8587	0.9951	0.9951
	0.07	0.9410	0.8424	0.8372	0.9878	0.9878
	0.1	0.9525	0.8495	0.8373	0.9862	0.9862
Pepper	0.03	0.8247	0.8199	0.8613	0.9631	0.9631
	0.07	0.8347	0.8370	0.8370	0.9926	0.9926
	0.1	0.8533	0.8522	0.8414	0.9892	0.9892
F-16	0.03	0.8382	0.8435	0.8435	0.9640	0.9640
	0.07	0.8291	0.8422	0.8335	0.9909	0.9909
	0.1	0.8322	0.8479	0.8322	0.9881	0.9881
Mandrill	0.03	0.8912	0.8940	0.8846	0.9415	0.9415
	0.07	0.8553	0.8472	0.8432	0.9811	0.9811
	0.1	0.8396	0.8372	0.8295	0.9903	0.9903

Table VI. Extracted watermarks on rotation attacks

Image	α	Rotaion 2 ^{0}	Rotaion 5 ^{0}	Rotation 45 ^{0}	Rotation 90 ^{0}	Rotation 180 ^{0}
Lena	0.03					
	0.07					
	0.1					
Zelda	0.03					
	0.07					
	0.1					
Pepper	0.03					

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	0.07					
	0.1					
F-16	0.03					
	0.07					
	0.1					
Mandrill	0.03					
	0.07					
	0.1					

From these observations, it is clear that method is strong enough to detect and extract watermark image from rotated images.

V. CONCLUSION

In this paper, performance of slant transform based watermarking technique is evaluated. LWT is used to decompose the original image. SVD is applied on the selected LWT sub-bands. The slant transformed watermark image is embedded in LWT and SVD transformed original image. Subsequently, the watermark image is extracted from watermarked image. The proposed method is found to be robust against common geometric attacks, cropping attacks and rotation attacks. The efficiency of proposed method is established with the help of experimental results.

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Development of Products and Services based on Kansei Engineering with Users' Motivation

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***Abstract*- This paper reports on an overview of the motivation from the basic theory, and is discussed its relationship to the use of products and services from the viewpoint of Kansei engineering. User experience is an important concept in the use of products or services, and is classified into pragmatic experience and Kansei experience. The pragmatic experience affected literacy by means of learning, or becoming accustomed to, device operation through the duration or repetition of usage, whereas Kansei experience refers to experience with impression and it increases users' motivation to use products and services. In the usage cycle of products and services, it can be expected not only increase motivation to use them but also serve as the driving force to maintain continuously use.**

I. INTRODUCTION

Although the word "motivation" has come into general usage in recent years, it was originally a psychological term. Motivation refers to the provision of a motive or intent, or a stimulus that causes it, and is also called "incentive" [1]. Motivation is considered to arise from within an organism and it becomes the source of energy that influences the organism's behavior. Motivation activates and directs behavior, and it is sustained until the behavior's goal is achieved. The preceding conditions of behavior are known as either motives or drives. A motive is a broad concept that can be long-term in nature and includes psychological/social aspects, whereas a drive is short-term in nature and has a physiological basis.

In addition, an individual's values or faith can underlie motives, as seen in esthetic or religious activity [2]. Therefore, human emotions can affect motivation management, be it preservation or improvement, and are reflected in human behavior. Therefore, motivation is a crucial concept in Kansei engineering.

Kansei engineering and affective engineering is "the science of translating the images and emotions representing human desires into physical design components, and specifically designing them [3]." The basic principle in the fields of ergonomics/human engineering and Kansei engineering/affective engineering is the central position of humans as consumers of goods and services. This includes the concept of the Human-Centered Design (HCD), wherein goods and services are designed for the primary purpose of meeting human needs. Ergonomics and human engineering focuses particularly on physical aspects or physiological characteristics of humans and seeks to design goods and services that humans can use with the most natural motions and states possible. Kansei engineering, however, focuses particularly on subjective psychological aspects, such as feelings and images. The goal is to design products that can have a positive effect on humans. Thus, Kansei engineering includes components that meet the expectations humans would have of a certain

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good or service and particularly emphasizes the enjoyable experience of its use. Users whose experiences of a good or service are followed by positive emotions become motivated to continue to use that good or service. This paper provides an overview on motivation, from the basic theory to its relationship to the use of products and services.

II. What is motivation?

Maslow described two categories of motives: deficiency motives, which include physiological and affective motives, and growth motives, which include intrinsic or achievement motives [4]. Deficiency motives serve survival and safety, and their fulfillment can be obtained by resolving the discomfort or tension arising from a deficiency, thus restoring the optimal state. Examples include avoiding physical discomfort such as hunger, thirst, oxygen deprivation, or pain, avoiding danger or unpleasant things to make the environment more stable, and avoiding interpersonal struggles or hostility. These deficiency motives are characterized by their cessation upon satisfaction. Growth motives, in contrast, produce a state of tension within the self to accomplish goals and challenge hardships and fulfillment is obtained by their accomplishment or mastery. They do not cease upon satisfaction but evoke new motivations indefinitely. Examples include the feeling of wanting to accomplish something, or the desire for something new or a change.

According to Maslow, human needs have a hierarchy (Fig. 1). Safety needs emerge upon fulfillment of physiological needs; after safety needs are fulfilled, belongingness and love needs emerge, followed by esteem needs [5]. In contrast to these four needs that comprise deficiency motives, growth motives arise from the need for self-actualization. The need for self-actualization has a self-sufficient quality and it emerges after all four deficiency-motivated needs are satisfied.

Based on this classification of motives and needs, motivation can be divided into inherent primary motives, motivated by physiological needs to survive or preserve one's species, and acquired secondary motives, which are not directly related to survival but learned by experience. The former are considered as physiological motivation and the latter as psychological or social motivations. Psychological motivation is primarily resolved within an individual and is related to functions of the cerebral cortex, such as experience and memory. In social motivation, relations with others, such as seeking social interaction, becomes the primary motive. These three forms of motivation are explained in the remainder of Section 2.

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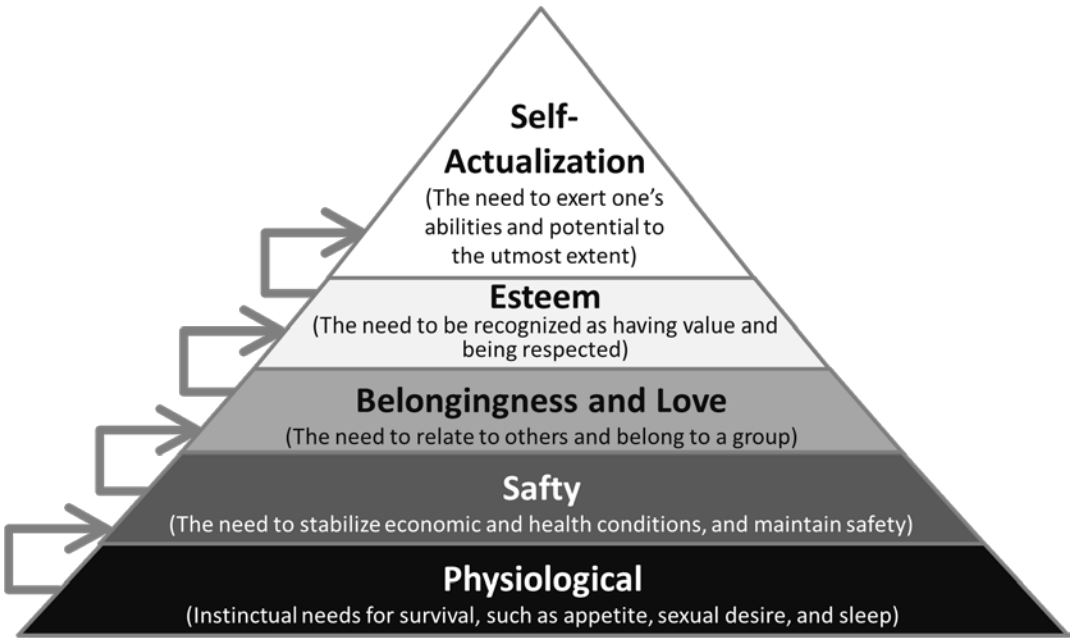

Figure 1. Maslow's hierarchy of needs (1948)..

A. Physiological Motivation

Physiological motivation is rooted in an organism's basic survival needs. Because these needs are necessary to survival or are innate behavioral needs, they are rarely affected by experience. Cannon defined homeostasis as the optimal equilibrium state of an organism within its environment and stated that disequilibrium of homeostasis generates all biological processes, including behavior, which continue until equilibrium is restored [6], [7]. For example, when physiological disequilibrium occurs because of hunger, thirst, or sleep deprivation, the homeostasis mechanism is activated and arouses behaviors such as eating, drinking, or sleeping to restore physiological equilibrium and return to the optimal state. Therefore, motives that optimize an organism's physiological state for survival are called homeostasis motives. Although these are physiological motives that occur unconsciously in humans, they are insufficient to explain all behavior, unless the humans are in an extreme state.

B. Psychological Motivation

Psychological motivations are resolved within an individual and seek various stimulations and activities that are not directly related to survival but have meaning in human life. They comprise intrinsic and cognitive motivations. These concepts were studied as a challenge to drive reduction theory, which was the mainstream theory in the 1950s. Drive reduction theory holds that organisms are inherently lazy, and they will not initiate behavior except in response to an unfavorable or unpleasant state of tension [8]. In contrast, the camp that emphasized intrinsic motivation conceptualized organisms as active beings that assertively interact with their environment as they pursue their own competence [9], [10]. Berlyne et al. defined intrinsic motivation as follows: "Intrinsic motivation is motivation that seeks internal results such as information, confusion, or enjoyment that arise from contrasts to internal and external stimuli, and variables such as novelty, complexity, surprise, and ambiguity form the core" [11]. Intrinsic motivation is thought to be based in curiosity (the

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motive to investigate when something new occurs and understand why and how it occurs), and this is a form of motivation in which the behavior itself is the goal.

There are cases where intrinsic motivation includes the concept of cognitive motivation, which is the motivation for accomplishment according to Atkinson's expectancy-value theory [12] or Locke's goal-setting theory [13]. For example, Deci considered accomplishment motives a special type of intrinsic motivation subdivided from fundamental intrinsic motivation, and he incorporated accomplishment motives into the framework of intrinsic motivation [14]. Expectancy-value theory holds that an individual's personality traits and expectation for success in accomplishing a task influence the generation of accomplishment behavior. Further, the two personality traits of motivation to accomplish and motivation to avoid failure along with the cognitive trait of likelihood or expectation of success determine accomplishment behaviors. Goal-setting theory holds that people constantly set goals and attempt to accomplish those goals. According to this theory, motivation to complete a task differs on the basis of the difficulty and intelligibility of the goal being achieved and the speed of feedback. Many businesses' current techniques for goal-management systems are based on this theory.

C. Social Motivation

As part of society, we humans have social needs such as to have a partner, to be recognized, to enjoy others' company, or to compete with others. Such needs related to social interactions with others, which prompt behavior because of the existence of others, are called social motivations. Social motivations are a form of extrinsic motives, which are resolved by obtaining an external reward. These motives are acquired within social contacts, such as from family and friends, or within the workplace. This phenomenon has also been studied over a long period of time. Murray categorized human needs and motives and demonstrated that of all the motives acquired within social relationships, achievement motives and affiliation motives are particularly important [15].

Achievement motives cause a person to make an effort to fulfill an extraordinary goal at a high standard or accomplish something difficult. Affiliation motives cause one to form and maintain friendly relationships with others, such as desiring to approach and interact with others who show a liking toward them, or to look for a partner. In regard to the relationship between these two motives, prior research has found that rejection anxiety forms the core of affiliation motives, and affiliation motives are a negative aspect in an achievement setting [16], [17]. A projective personality test using images called the Thematic Apperception Test (TAT) [18] and a personality test by self-reporting survey using the pair comparison method called the Edwards Personal Preference Schedule (EPPS) [19] were developed on the basis of Murray's classifications of social needs and are used to measure the strength of achievement and affiliation motives. However, the results of these two personality tests are not congruent. There are indications that the TAT can measure only a general behavioral trend, and that these trends differ from behavioral trends in a specific setting, which the EPPS can measure [20].

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III. Motivation and the Use of Products and Services

User experience (UX) is considered crucial in the use of products or services. This perspective is reflected in the revision of the international standard ISO 13407: 1999 regarding HCD. The ISO 9241- 210: 2010 has newly defined UX as a person's perception of and reaction to the use of goods and services. This standard gives HCD the goal of "achieving a good UX" [21], [22]. The notes of this definition state that UX includes a user's complete physiological and psychological reactions and attitudes—including perceptions, emotions, and preferences—before, during, and after using the good or service. These are affected by the brand image or design, function, operability and effectiveness, and operational support of the goods and services and the user's physiological/psychological states and abilities based upon previous experiences. UX refers to the entire range of a user's experiences according to ISO 9241-210, and it is divided between pragmatic and Kansei experiences.

Although Kansei experience refers to experience that accompanies sensations, Hayami et al. indicate that because the contents of Kansei experience are deeply ingrained in the experiencer's memory as being extremely impressive, they enable contemplation and long-term retention [24]. It has also been suggested that Kansei experience increases motivation. The author has conducted research specifically examining Kabsei experience in the relationship between literacy and cell phone or personal computer use experience. The results demonstrated that pragmatic experience affected literacy by means of learning, or becoming accustomed to, device operation through the duration or repetition of usage, whereas Kansei experience affected the desire for and motivation to use the device [25]. Further, a particularly positive emotion accompanying an experience increased the desire for and motivation to use the device. This experience of positive emotion can be expected to further improve literacy. The sense of accomplishment accompanied by positive emotions becomes stronger because the cognitive gap creates a significant contrast effect, towing to a rapid change from unpleasant to pleasant. This raises an individual's self-efficacy particularly effectively, which in turn increases motivation [26]. Through Kansei experience, the instance of an external accomplishment or resolution event, with the synthetic evaluation of the event or occurrence in the background, is strongly stored in the memory with mental and physical sensations and cognitive operations by the multilayered synergy effect, arousing a person's latent and overt goal behavior. The continued use of products and services through the usage cycle can be expected not only increase motivation to use them but also serve as the driving force to maintain this use.

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Opportunistic diagnosis using Particle Swarm Optimization in Wireless Body Area Network

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Abstract —This paper discusses the area of bioinformatics which includes methods for storing, retrieving, organizing and analyzing biological data. Gathering new information from the real time measured data provides opportunity for preemptive diagnosis & timely action. This may include remote consulting & surgery supervision as enhanced goals. Wireless Body Network is a mesh of various sensors on the body of a human, for measurement of their physiological parameters. WBAN environment, the data is unique, real time & huge. Here, classification system is designed for blood pressure, blood sugar & ECG, that aims to predict healthiness/disorders. For analysis we store the patient's data, apply classification rules on existing data(medical data varies on the basis of age, sex, region, time, position etc.) and layout the best rule based on accuracy(Customization). This medical data is critical as it serves as a primary data and it must be ensured that there is minimal delay in storing, analyzing & classifying it as normal & abnormal efficiently.

Keywords-medical data,Sensor,Classification, WBAN, PSO

I. INTRODUCTION

Awareness about health and related happiness is welcomed by all. Erupted growth in technology today has fuelled the existence of wireless devices & services. In the recent years concern for medical healthcare has increased and the zeal to live longer independently has given birth to WBAN [1]. People have more concentration on avoidance and early risk recognition. Thus, there is a requirement of design and development of a model that measure, monitor, store & retrieve medical data at any time & place to far care providers or clinic. IEEE Standard Group had been involved in this area and has developed a network protocol which is suitable for operation around, on & inside the human body: IEEE 802.15.6, also known as Wireless Body Area Networks (WBAN)[2]. Related technologies Wireless Sensor Network (WSN) and Cellular Communication all have enormous applications and exponential market potential.

Sensor nodes in WBAN are embedded in the skin or are placed on the surface of the human body. When the sensor (with transmission capabilities) sends packets, signals reach the receiver through skin or the air interface. In WBAN the amount of sensor data is huge because it is real time & it is being monitored(which is a continuous process), it takes more space to store, the monitored data manually takes more time to analyze from doctor and the number of such patients can also be huge[3]. Hence here, we suggest the System Design; it can classify the sensed data as normal and abnormal using Particle Swarm Optimization (PSO) algorithm and send the data of the abnormal cases to the medical professional for diagnosis, an email or SMS can be sent to the patient to aware him/her of the situation. The medical professional views the same & instructs on the further actions of either changing the dosage or alerting the Patient/patient's relative.

II. BACKGROUND

A. Wireless Body Area Network

Development & deployment of wireless network is increasing due to the current advances in wireless technology, low power microelectronics and miniaturization with the growing trends in wireless networking [4]. Sensor networks majorly comprise of autonomous monitoring and controlling environments. Human health monitoring is one of the more promising sensor network applications. Wireless body area network is about placing tiny wireless sensors on/in the body of human, a variety of vital signs can be monitored and generate real time

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comment to the user and doctor. Non-Patient or Patient can get complete medical consultation and the data can be sent to the hospital from any location. Technology helps to get detailed and accurate signal measurements, as if they had been physically present in a medical center; this is referred as "ubiquitous medical care". WBAN comprises of portable and communicating sensors. These sensors either reside inside the human body or are worn. They observe vital body signals and actions. These devices use wireless technologies for communication and transmit data from the body to a base position, from where data is relayed to a hospital in real time.

B. *Characteristics of WBAN are as follows:*

- Due to the network's proximity to the human body, electromagnetic pollution should be extremely low [5]. So a non invasive (not implanted in the body) WBAN requires that every node transmits at an extremely low power.
- A suitable technology for the non invasive WBAN is the new and emerging ultra-wide band (UWB). The device to be used should have limited energy resource & should be very small.
- It is difficult to frequently change the batteries in the sensors that are implanted in the human body of WBAN; hence a long battery lifetime is required.
- Multiple communications (Communication indirectly through several intermediate nodes) are used to transmit to a far node with less power.
- Optimum node density (number of active nodes in a network to provide better connectivity) is required for delivering the maximum number of data packets with minimal delay.
- Efficient and cost effective WBAN solutions are necessary to gain the popularity of WBAN.
- Usually node communication is simplex in nature & is customized to the user.
- Waves propagation carried out on or in the medium like the human body, get attenuated significantly till they reach the receiver. Hence, a simple but accurate propagation model is required.
- Device is quite heterogeneous and has unique requirements and need different network resources in terms of data rates, power consumption, and reliability.

C. *Network Architecture of WBAN*

Multitier network architecture for WBAN for health monitoring is shown in Fig 3.1 Tier 1 consists of a number of sensor nodes spread over the body, each node comprises of a sensor for capturing data, signal conditioner to shape the captured signal, analog to digital converter to convert the captured signal to digital signal, microcontroller for processing the digital data with a transmitter for transmission purpose. Every user wears sensor nodes that are tactically located on the body of human. The primary function of these sensor nodes is to transfer the relevant data to the tier 2 devices like personal server, WLAN, Cellular phones etc. Tier 2 sets up the connectivity to transfer the health status information to the medical server using internet or mobile telephone networks. Internet connection to a medical server resides at tier 3. Tier 3 is connected on a health server and it is optimized to give service to thousands of individual users and health care professionals far & near.

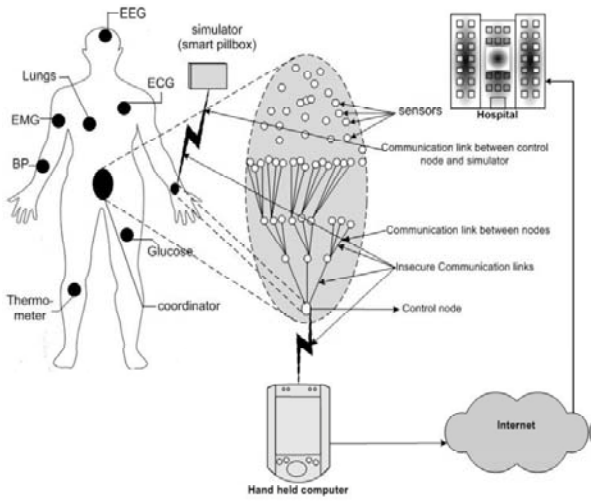

Fig 2.1 Architecture of WBAN

D. *Particle swarm Optimization*

1) Origin: Proposed by Eberhart & Kennedy in 1995, the Particle Swarm Optimization (PSO) is the outcome of behavior of birds and their flock intelligence [16]. Birds communicate and share

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information with their companion. This is based on their personal best experiences and the swarm's experiences; they align their trajectory to locate food for each individual at earliest. Hence, the swarms start their flight towards the known direction. PSO has its own memory; it shares the information with neighbors then adjusts its behavior to align with the swarm's best experiences. These unique features enable PSO convergence rapidly. Solution set after a number of iterations is the closest to accuracy. "PSO algorithm has been applied to solve Traveling Salesman Problem, industrial load scheduling, routing optimization and complex non-linear optimization problems [7], [8]."

2) Initialization: PSO starts with generating a large number of initial particles, distributed in search space randomly. Typical range of particles is 20 -40. Less number can lead to early convergence on the local best whereas more particles can take huge time to find the global best. Every particle orients at its own velocity and location. Each location in search space, corresponds a fitness value, points a possible solution. Below are listed the mathematical expressions:

V_i^0: Initial velocity of particle i
X_i^0: Initial position of particle i

3) Fitness Function: It is a mathematical expression during problem solving process. Particle's position is substituted in the fitness function, leading to a fitness value. This value helps to understand the features of a particle. Fitness Function in PSO: Mathematical expressions are listed below:
f: Fitness function
f (X_i^0): Fitness value of particle i at the kth iteration

4) Search Process: In this each particle memories positions nearing better fitness value, then comparing at the k+1th iteration with the previous. Supposing the fitness value of the current position is better than that of the global best solution, the position found by the particle and its fitness value will be used to update the fitness value and the position of the global best solution. Following are the mathematical expressions.

$$P_i^{k+1} = \begin{cases} X_i^{k+1}, f(X_i^{k+1}) \le f(P_i^k) \\ P_i^k, f(X_i^{k+1}) > f(P_i^k) \end{cases}$$

$$P_g^{k+1} = \begin{cases} P_i^{k+1}, f(P_i^{k+1}) \le f(P_g^k) \\ P_g^k, f(P_i^{k+1}) > f(P_g^k) \end{cases}$$

Where

P_i^k =Local best position of particle i at the *k*th iteration
P_g^k =Global best position of particle I at the *k*th iteration

5) Velocity and Position Updates: Each particle adjusts its own velocity and position according to its current velocity, the positions of the local best and global best solutions. Velocity of the particle is randomly generated towards the local best and the global best positions can determine the velocity of the particle in the next iteration, as shown in the given equations: particle uses the collective experiences of the swarm: moving toward its best previous position and even toward the best the swarm has met.

$$V_i^{k+1} = V_i^k + c_1 r_1 \left(P_i^k - X_i^k\right) + c_2 r_2 (P_g^k - X_i^k)$$
$$X_i^{k+1} = X_i^k + V_i^{k+1}$$

Where
V_i^k = Velocity of particle i at the *k*th iteration
X_i^k = Position of particle i at the *k*th iteration
P_i^k = Personal best position of particle i at the *k*th iteration
P_g^k = Global best position of all particles at the *k*th iteration
c_1, c_2 = Coefficient of acceleration in [0,4]
r_1, r_2 = Random numbers in [0,1]

6) Flowchart:

Step1: Initialize each particle

Step2: Using fitness function , find fitness value

Step3: Search

Step4: Update P_i^k P_g^k

Step5: Align to new position and velocity of each particle.

Step6: Determine if max count of iterations reached or end criteria are met. If not go back to Step 3

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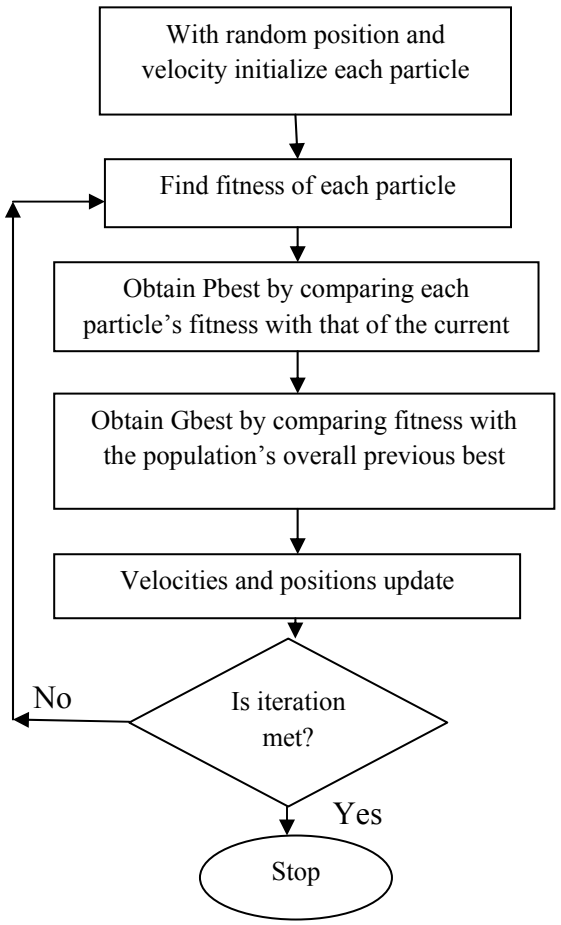

Fig 2.2 Flow Chart of PSO

III. SYSTEM REQUIREMENT & DESIGN

Functional Requirement provides a software system function and specifies the model behavior when offered with definite inputs or conditions. These also may comprise calculations, data manipulation, processing and other definite functionality. Below are the functional requirements.

1. Particle Swarm Optimization (PSO) is utilized for classification of large amount of blood glucose and ECG data efficiently.

2. Support vector machine (SVM) is needed to separate the normal and abnormal cases after the classification of data.

The method of giving different procedures and ideas for the reason of defining a method or a system in satisfactory points to allow physical understanding of the system is called as system design.

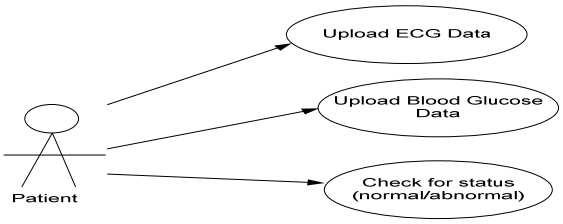

Fig 3.1 Depicting system requirements for Design

Design Issues

Some of the design issues to be considered for designing a WBAN system are as follows:

1. Sensor Node: Motion and position sensors are the nodes in WBAN. They are accelerometers, human health observing sensors such as ECG, EMG, blood sugar and environment sensors such as oxygen, pressure, temperature sensors.
2. Node Sampling Rate: Frequency of any induced activities of human is in between 0 and 18 or 30. Therefore sampling rate of 10-100 Hz is enough for the sensor node without losing any data.
3. Operating Power: Sensors should be more power-efficient. Most of the sensors in WBAN use battery for their operation. This battery need to keep the charge for long time without any maintenance..
4. Sensor Size and weight: Ideally the size and weight of the sensor should be small.
5. Identification and association of sensors node: Every node is identified by the unique device ID.
6. Calibration of sensor node: For the sensor node, there are two types of calibrations. One is calibration of sensor used to place the sensor to sensor changes & customized to the user. When replacement of sensor or any sensor newly included in to the network, it should be calibrated depending on the requirement. This type of calibration is needed only once; however it is required for preparation of sensor. The other type is calibration of session. This is needed instantly before starting a new observing session to calibrate the sensor in the situation of its current environment.
7. Processing: Intelligent on-sensor signal processing, transmit the processed data rather than raw data to save power as it helps in extending the battery life. For an optimal

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design a careful trade-off between calculation and communication is essential.

8. Social Issues: WBAN system social issues include privacy, security and legal aspects due to communication of health data between server and sensor node, communication through WBAN and internet must be encrypted to take care of user's privacy. Legal instructions are essential to control access to patient – identifiable information.

IV. System Architecture

System architecture predicts the format and behavior of a system and is the theoretical design. Architecture is the expression of a system, planned in a manner that helps analysis regarding the system structural properties. It describes the system apparatus and gives the vision of products that can be obtained and systems designed, it works collectively to execute the whole system. The architecture of the system is shown below:

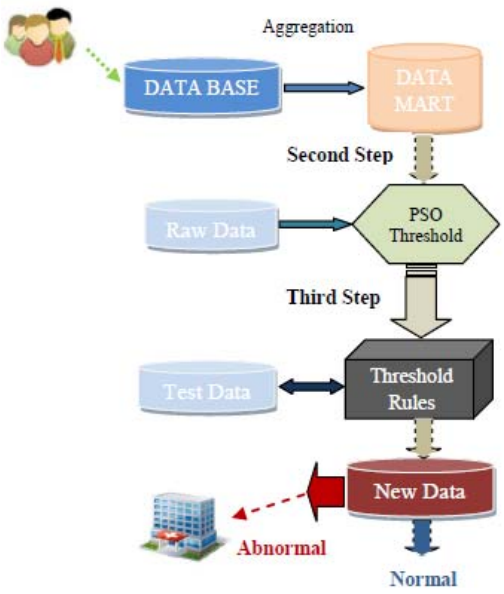

Fig 4.1 System Architecture

V. Implementation & Analysis

In implementation conceptual design is turned into a working system. Implementation requires careful planning; investigation of system and constraints, design of methods to achieve the changeover, evaluation of the changeover method, correct decisions regarding selection of the platform, appropriate selection of the language for application development.ECG and blood sugar data classification is implemented in windows 7 operating system using MATLAB. Sensor would sense the vital signals of the patients for every minute and send this data to the microcontroller. Microcontroller converts this analog data into digital and transfers this data to the PC through Bluetooth. In PC this data is stored in text file. We have implemented the same by collecting the data from the hospital & stored it in text file & implemented the classification rules. The results indicated normal & abnormal data, the normal is ignored & the data pertaining to abnormal patients is sent to the doctor mail for intervention & to alert the patient.

Function	Tests done	Remarks
Browse GUI	Tested to check whether the browse function opens file chooser window to choose call input file.	Success
Update Database	Tested to check whether the ECG and Blood glucose data are uploaded into database.	Success
Aggregation	Tested to check whether the patient data were aggregated.	Success
PSO Classification	Tested to check whether the classification done for patients data and generate rules.	Success

Table 4.1 Unit testing table

VI. RESULTS

The following snapshots are the results that we got after step by step execution of all the modules of the system.

User Interface -Below figure shows the user interface of the project.

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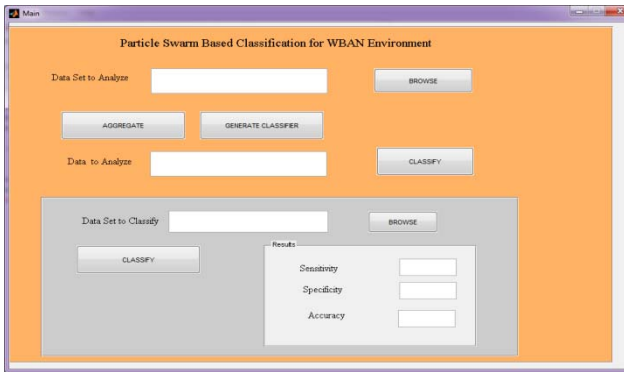

Fig 5.1 User Interface

Data Browsing - Huge sensor data stored in the dataset text file as shown below:

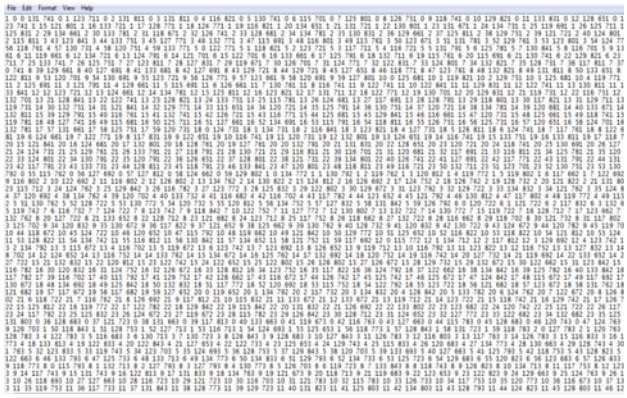

Figure 5.2 Sensor Data

Data Aggregation - Browsed data is aggregated by clicking on the aggregation button. Here aggregation is done by finding the average value of the sensed data for an hour. Aggregated data for each hour is shown bellow.

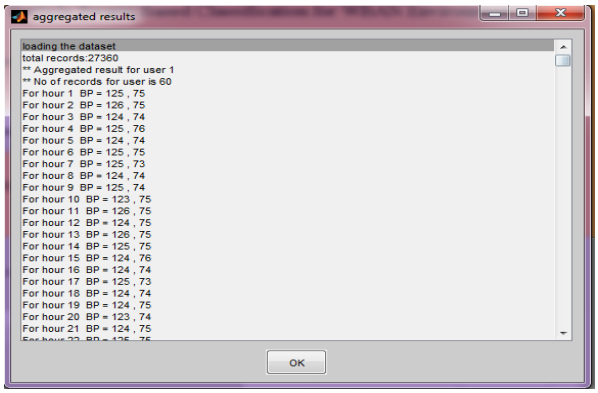

Fig 5.3 Aggregated Data

Data Classification -Aggregated data is classified by clicking on generate classifier button. This will classify the data as normal and abnormal. Bellow figure shows the classified data. Here pink color indicates the normal data and green color indicates the abnormal one. This is done by using PSO.

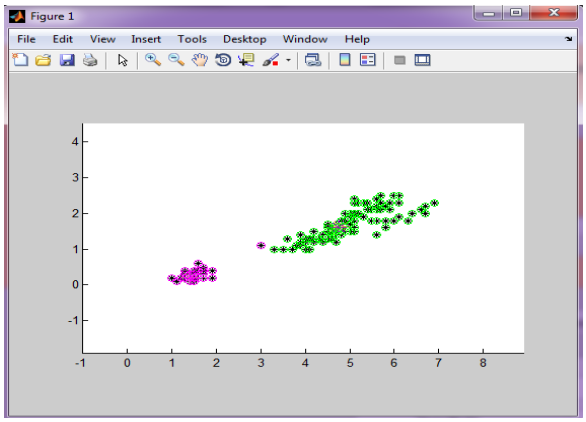

Fig 5.4 Classified Data

Fitness Value- Before classification of the data, fitness value for each aggregated data is found out. Calculated fitness values and number of iterations are shown below:

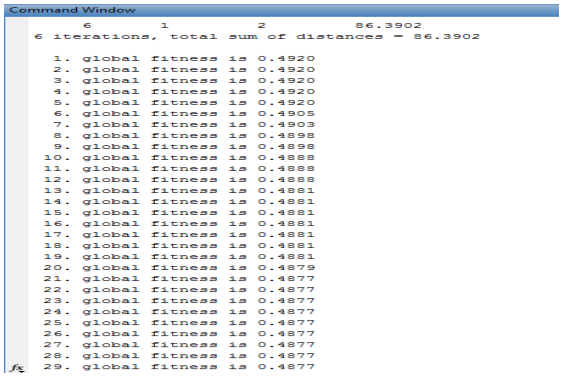

Fig 5.5 Fitness Values

Sensitivity, specificity and accuracy of the system - Sending abnormal data: We can observe sensitivity, specificity and accuracy of the system we can find the abnormal patient with patient ID. Then this particular patient information is send to the hospital database.

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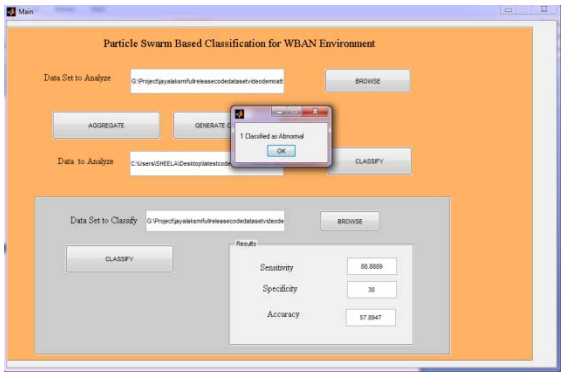

Fig 5.6 Abnormal data detection

VII. ADVANTAGES AND APPLICATION

Advantages

1. Save the diagnosis time of the medical professional.
2. Medical professional can treat more number of patients.
3. Reduces the death rate of patients.
4. This is accurate.

Applications

1. All diabetic and heart disease patients can use this system.
2. This can be used in u-health care services.

VIII. CONCLUSION & FUTURE ENHANCEMENTS

In this paper, the PSO Classification algorithm is suggested & applied. Rules to analyze ECG & blood sugar are modeled to improve the time performance. The system architecture is proposed to automatically classify normal and abnormal data as the first diagnosis before medical professional actually analyze the patient's data. If patient's data is classified as abnormal, the data will be sent to medical professional for monitoring and get a second diagnosis. Thus medical professional near or far can give diagnosis to patients in a timely and efficient manner.

In future research on the topology of the new pattern particle swarm which has a better function can be carried out. The neighboring topology of the different particle swarms are based on the imitation of the different societies. It is meaningful to the use and spread of the algorithm to select the proper topology to enable PSO. PSO has the best property and do the research on the suitable ranges of different topologies and also blending PSO with the other intelligent optimization algorithms means combining the advantages of the PSO with the advantages of the other intelligent optimization algorithms to create the compound algorithm that has practical value and the effect can be found out in the practical application. Although the PSO algorithm has been used widely, it will be very meaningful to explore the developing areas in the field of wireless communication, cloud computing where data classification is required.

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Face Recognition using an HD PTZ Camera in a Virtual Classroom

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***Abstract*— Advancement in the technology has paved path for a new educational nomenclature, i.e., 'Virtual Classroom'. Virtual Classroom is a teaching-learning environment like the traditional classrooms but offers a wide range of learning flexibility in the virtual environments when compared to traditional education systems. The main hitch in the existing systems is the lack of proper interaction between the students and the teacher. Therefore, this research work focuses on detecting the students in the classroom, recognizing the face of the student who has raised hand for a doubt, and displaying the details of the student such as student name and student id of that particular student. An High Definition Pan-Tilt-Zoom Camera is used to monitor the students and capture their images. The Virtual Classroom specific system makes use of the popular Viola-Jones algorithm for real time Face Detection, Hand-raise Gesture Detection and face of the hand raised student is extracted using image segmentation and morphological operation, followed by point feature extraction and finally Face Recognition is done using Eigen Faces. Thus, the virtual learning environments through proper Face Recognition with special attention to students' needs or queries are an important aspect for a better learned society.**

Keywords-Face Detection, Face Recognition, Hand-raise Gesture Detection, Virtual Classroom

I. INTRODUCTION

Face Recognition, a kind of biometric software is a hotspot in computer vision technology and has become one of the most crucial aspects in today's world due to its increasing real world applications namely video surveillance, security checks in banks, airports and many more [1],[2]. One of its most popular applications is in Virtual Classroom. In a Virtual Classroom environment, where the interaction of students and teacher is necessary, Face Recognition plays an important role.

Virtual Classroom has taken a lead role in the edification-cognition process offering a wide range of innovative features, by engaging learners in the learning process and delivering enriching learning experiences [3]. Recent researchers have found that online courses bolster basic skills, administration, correspondence and critical thinking. Even though, the existing systems offer a wide platform for the education system but the main challenge is in the interaction between students and the teacher. Therefore, developing a system that compensates the problems in virtual classroom has become a necessity.

An HD PTZ Camera is capable of remote directional control and auto-tracking [4]. The PTZ Camera is used to monitor the students in the classroom, recognize the face of the student who has raised hand for a doubt and display the details of the recognized face such as student name and student ID, which makes the class more interactive. This research work includes Face Detection, Hand-raise Gesture Recognition and Face Recognition. The Viola-Jones algorithm is used for detecting the faces of student; real-time approach for Hand-raise Gesture Detection and Face Recognition includes capturing the images using camera, segment the image and perform morphological operation and finally is sent to a point feature extraction stage.

II. PROPOSED SYSTEM

The primary step in a Face Recognition system is data acquisition. The proposed method of Face Recognition is based on a multistage architecture. The system has three stages: Face Detection, Hand-raise Gesture Detection and Face Recognition which is shown in Fig.1.Three subjects/students are considered for the study in a classroom.

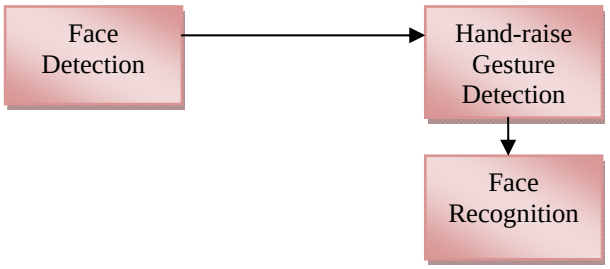

Fig.1 Block diagram of the Proposed Face Recognition System

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An HD PTZ Camera is used to monitor the students in the classroom, captures their images and sends the data to the destination laptop or PC. Fig.2 shows the basic system architecture of the proposed system.

Fig.2 System Architecture

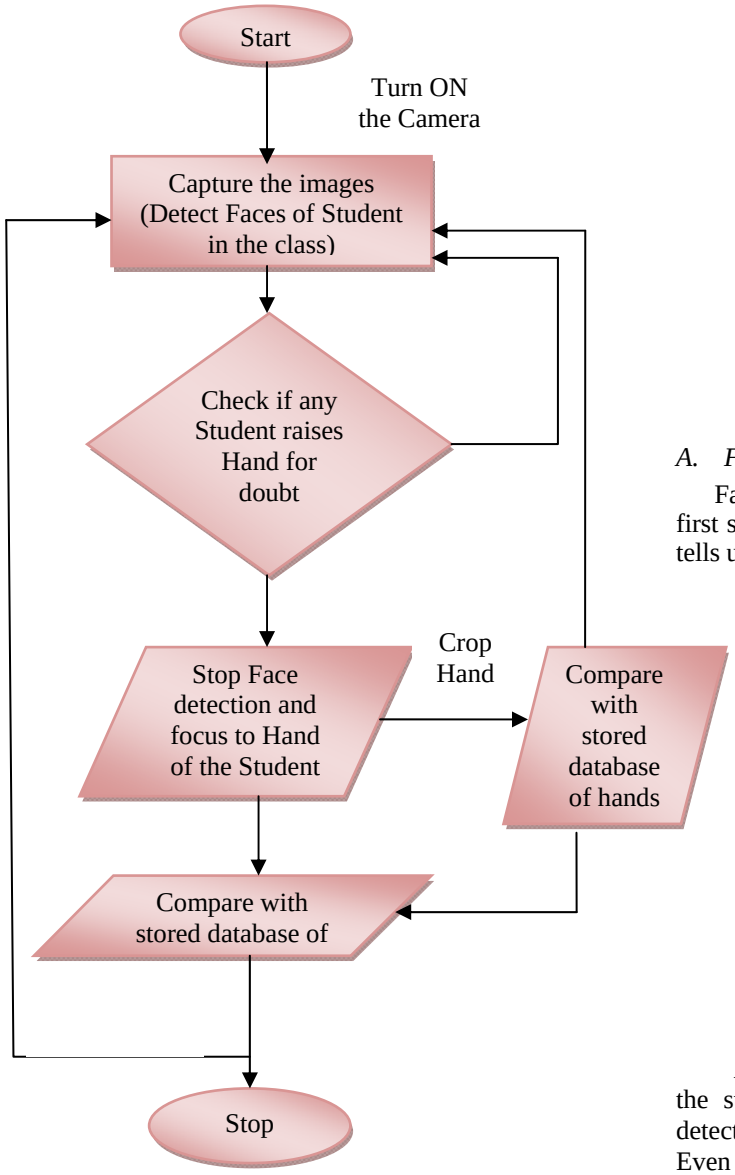

Fig.3 Flow Chart

Fig.3 depicts the flow chart of the designed system.

The steps are as follows:

1. Turn ON the camera.
2. Detect the faces of student. Draw bounding box across the face of the student.
3. Check if any student raises hand for doubt. If no student has raised hand, go again to step 2 else go to step 4.
4. Stop face detection and zoom to the student who has raised hand.
5. Crop the hand and face of the student and check if the hand is in the stored database of hands, if hands not found in database go to step 2 else go to step 6.
6. If hand found, check if the cropped face is in the stored database.
7. If face recognized, display the name and roll number of the student and stop the detection for some time and clarify the doubt of the student else go to step 2.

A. Face Detection

Face Detection , a special class of object detection is the first stage in many face recognition systems[5].Face Detection tells us whether there is any face in the picture or not

Fig.4 Face Detection

A virtual classroom of three students is considered for the study. The faces of the student in the classroom are detected using the face detection algorithm, Viola - Jones. Even though training is slow but detection using Viola - Jones is fast. Therefore, Viola-Jones is widely used for Face Detection.

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In this research work, Viola-Jones Face Detection is implemented using built-in matlab libraries. The input images are captured using an HD PTZ Camera. The output is a bounding box around the face of the student. . The algorithm has four stages namely Haar Feature Selection, Creating an Integral Image, Adaboost Training and Cascading Classifiers. Integral Images are used for fast feature evaluation, Adaboost Training for fast feature selection and Cascading Classifiers for fast rejection of non-face windows. The algorithm proceeds as follows [6],[7]:

1. Haar feature types used in detection frame involves the sum of image pixels within the rectangle area.

2. Integral image evaluates the rectangular features so as to achieve faster computation in constant time. The integral image can be efficiently computed in a single image pass using recurrences.

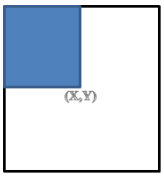

Fig.5 Integral Image Representation

The integral image at (X, Y) is the sum of pixels above, to the left of (X,Y) and inclusive of (X,Y).

TABLE I. ORIGINAL IMAGE VALUE

0	1	2
1	2	3
2	3	5

TABLE II. INTEGRAL IMAGE VALUE

0	1	3
1	4	9
3	9	19

3. In a standard 24x24 pixel sub window, there nearly 160000 possible features but it is impractical to compute all of them. Therefore, we have to select a subset of relevant features, which are informative to model a face. Each rectangle feature may be regarded as a single weak classifier. Adaboost performs a series of trials, each time selecting a new weak classifier. During each iteration the sample image receives a weight determining its importance. At the end, carefully make a linear combination of all the weak classifiers, obtained after the iterations.

4. We begin with simple classifiers, which reject most of the negative sub windows and accept the positive ones. A positive result from the first classifier triggers the second and the process continues so on. On an average much fewer features are computed per sub window with equal distribution time to each sub window.

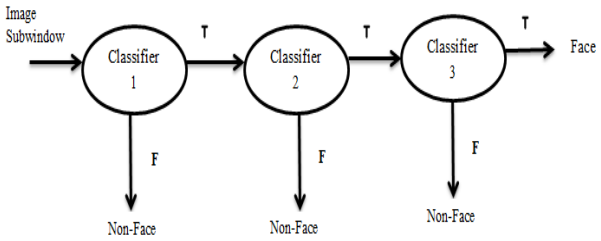

Fig.6 Cascade Detector

Stages are added until the overall target for false positive and detection rate is met and each stage is trained by adding features for detection the faces.

B. Hand-raise Gesture Detection

Hand-raise Gesture Detection possesses extensive applications in virtual reality and provides us a new way for providing communicating with the virtual environment. In the mentioned method, we first collect the hand-raise gesture of the students in the classroom.

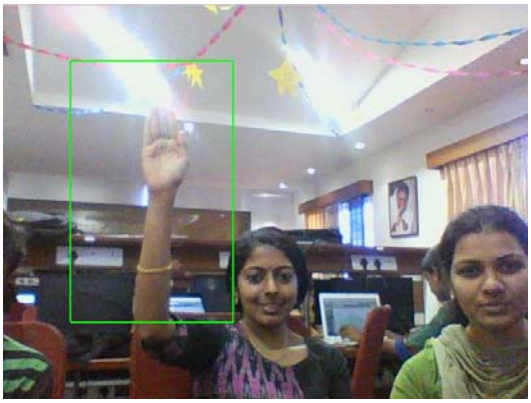

Fig.7 Zooming to Hand Raised Student to Capture Hand

When a student raises hand for a doubt, focus to the hand by defining proper boundary and crop the hand of the student. The cropped hand of the hand raised student is compared with stored database of hands.

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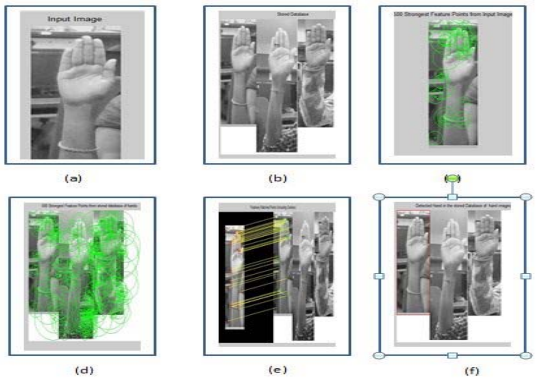

Fig.8 Hand-raise Gesture Detection

All subfigures from (a) to (f) in Fig.5 depicts that the hand of a student in the class is raised, as it shows match with the stored database of hands.

A point feature matching algorithm is used to match the features of the captured hand with the stored database of hands of the three students in the class. Thus, subfigures from (a) to (f) has used the point feature matching algorithm that includes the following steps [8]:

1. Read the images i.e. cropped hand of hand –raised student and the stored database
2. Detect feature points in both images
3. Extract up to feature descriptors at the interest point in the extracted hand and stored database of hands
4. Match the features using their descriptors.
5. Locate the hand in the stored database that shows maximum match of hand raised student using putative matches
6. Draw bounding box around the stored database image which shows the greatest match confirming that a student in the class has raised hand

Thus, the process of Hand-raise Gesture Detection is confirmed.

C. Face Recognition

The camera zooms to the student who has raised hand for a doubt. The face of the hand raised student is cropped and this face is compared with the stored database to confirm whose face was captured using the camera.

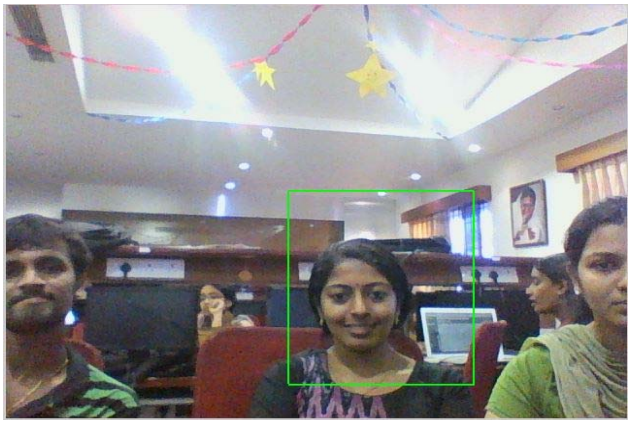

Fig.9 Zooming to the Face of Hand –raised Student

Fig.10 Face of the Hand –raised Student

Problems in face recognition arise if the image is of high dimensionality. Therefore, it is important that we first map the data to a lower dimensional sub-space. Principal Component analysis is one such powerful tool in image processing, which helps to reduce the dimensionality of images while retaining the characteristics of a given database. The Principal component analysis is used to extract the Eigen Faces [9].Listed below are the general steps for Principal Component Analysis [10]:

1. Take the whole datasets of n-dimensional samples and convert the RGB images to Grayscale.We have the input images $I_1, I_2 \ldots\ldots I_N$ i.e., $\sum_{i=1}^{N} I_i$
2. Vectorise and compute the mean vector of the whole dataset. Represent every image I_i *as* a vector Γ_i and the mean vector $\Psi = \frac{1}{N}\sum_{i=1}^{N}\Gamma_i$
3. Subtract the mean face i.e., $\Phi_i = \Gamma_i - \Psi$ and compute the covariance matrix of the whole dataset, where covariance matrix $C = \frac{1}{N}\sum_{i=1}^{N}\Phi_m \Phi_m^T = A\,A^T$ (M^2 x M^2),where $A=[\Phi_1\ \Phi_2 \ldots\ldots\ \Phi_N]$
4. Obtain the Eigen values and corresponding Eigen vectors and sort the Eigen vectors by decreasing Eigen values and choose m Eigen vectors with largest Eigen values to form a nxm dimensional matrix

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5. Use the nxm dimensional matrix to transform the samples onto the new subspace and we get the Eigen face
6. Compute the Euclidean distance of the test image and stored database
7. The image with minimum Euclidean distance gives the desired result

Fig.11 Face Recognized

Thus, face recognized displaying the details of the student in the class.

III. CONCLUSIONS & FUTURE WORK

A face recognition system that gives the details of the student in a virtual classroom is designed. Whenever the student raises hand for a doubt, the PTZ Camera which is used to monitor the student in the classroom, is zoomed to the particular student to capture the student images and display the student name and student ID along with the face of the student. The experimental results show that a better and interactive education system has been designed for the learners in a virtual classroom. In future, more students can be considered for the study, with a multiple recognition system i.e., recognizing multiple students who has raised hand for a doubt, also include database of students with varying pose and identify new faces not included in the database and add it to the database.

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Broadband wireless technologies: LTE, WiMAX, WiRAN, HSDPA, HSUPA, Resource allocation and interference management, Quality of service and scheduling methods, Capacity planning and dimensioning, Cross-layer design and Physical layer based issue, Interworking architecture and interoperability, Relay assisted and cooperative communications, Location and provisioning and mobility management, Call admission and flow/congestion control, Performance optimization, Channel capacity modeling and analysis, Middleware Issues: Event-based, publish/subscribe, and message-oriented middleware, Reconfigurable, adaptable, and reflective middleware approaches, Middleware solutions for reliability, fault tolerance, and quality-of-service, Scalability of middleware, Context-aware middleware, Autonomic and self-managing middleware, Evaluation techniques for middleware solutions, Formal methods and tools for designing, verifying, and evaluating, middleware, Software engineering techniques for middleware, Service oriented middleware, Agent-based middleware, Security middleware, Network Applications: Network-based automation, Cloud applications, Ubiquitous and pervasive applications, Collaborative applications, RFID and sensor network applications, Mobile applications, Smart home applications, Infrastructure monitoring and control applications, Remote health monitoring, GPS and location-based applications, Networked vehicles applications, Alert applications, Embeded Computer System, Advanced Control Systems, and Intelligent Control : Advanced control and measurement, computer and microprocessor-based control, signal processing, estimation and identification techniques, application specific IC's, nonlinear and adaptive control, optimal and robot control, intelligent control, evolutionary computing, and intelligent systems, instrumentation subject to critical conditions, automotive, marine and aero-space control and all other control applications, Intelligent Control System, Wiring/Wireless Sensor, Signal Control System. Sensors, Actuators and Systems Integration : Intelligent sensors and actuators, multisensor fusion, sensor array and multi-channel processing, micro/nano technology, microsensors and microactuators, instrumentation electronics, MEMS and system integration, wireless sensor, Network Sensor, Hybrid

Sensor, Distributed Sensor Networks. Signal and Image Processing : Digital signal processing theory, methods, DSP implementation, speech processing, image and multidimensional signal processing, Image analysis and processing, Image and Multimedia applications, Real-time multimedia signal processing, Computer vision, Emerging signal processing areas, Remote Sensing, Signal processing in education. Industrial Informatics: Industrial applications of neural networks, fuzzy algorithms, Neuro-Fuzzy application, bioInformatics, real-time computer control, real-time information systems, human-machine interfaces, CAD/CAM/CAT/CIM, virtual reality, industrial communications, flexible manufacturing systems, industrial automated process, Data Storage Management, Harddisk control, Supply Chain Management, Logistics applications, Power plant automation, Drives automation. Information Technology, Management of Information System : Management information systems, Information Management, Nursing information management, Information System, Information Technology and their application, Data retrieval, Data Base Management, Decision analysis methods, Information processing, Operations research, E-Business, E-Commerce, E-Government, Computer Business, Security and risk management, Medical imaging, Biotechnology, Bio-Medicine, Computer-based information systems in health care, Changing Access to Patient Information, Healthcare Management Information Technology. Communication/Computer Network, Transportation Application : On-board diagnostics, Active safety systems, Communication systems, Wireless technology, Communication application, Navigation and Guidance, Vision-based applications, Speech interface, Sensor fusion, Networking theory and technologies, Transportation information, Autonomous vehicle, Vehicle application of affective computing, Advance Computing technology and their application : Broadband and intelligent networks, Data Mining, Data fusion, Computational intelligence, Information and data security, Information indexing and retrieval, Information processing, Information systems and applications, Internet applications and performances, Knowledge based systems, Knowledge management, Software Engineering, Decision making, Mobile networks and services, Network management and services, Neural Network, Fuzzy logics, Neuro-Fuzzy, Expert approaches, Innovation Technology and Management : Innovation and product development, Emerging advances in business and its applications, Creativity in Internet management and retailing, B2B and B2C management, Electronic transceiver device for Retail Marketing Industries, Facilities planning and management, Innovative pervasive computing applications, Programming paradigms for pervasive systems, Software evolution and maintenance in pervasive systems, Middleware services and agent technologies, Adaptive, autonomic and context-aware computing, Mobile/Wireless computing systems and services in pervasive computing, Energy-efficient and green pervasive computing, Communication architectures for pervasive computing, Ad hoc networks for pervasive communications, Pervasive opportunistic communications and applications, Enabling technologies for pervasive systems (e.g., wireless BAN, PAN), Positioning and tracking technologies, Sensors and RFID in pervasive systems, Multimodal sensing and context for pervasive applications, Pervasive sensing, perception and semantic interpretation, Smart devices and intelligent environments, Trust, security and privacy issues in pervasive systems, User interfaces and interaction models, Virtual immersive communications, Wearable computers, Standards and interfaces for pervasive computing environments, Social and economic models for pervasive systems, Active and Programmable Networks, Ad Hoc & Sensor Network, Congestion and/or Flow Control, Content Distribution, Grid Networking, High-speed Network Architectures, Internet Services and Applications, Optical Networks, Mobile and Wireless Networks, Network Modeling and Simulation, Multicast, Multimedia Communications, Network Control and Management, Network Protocols, Network Performance, Network Measurement, Peer to Peer and Overlay Networks, Quality of Service and Quality of Experience, Ubiquitous Networks, Crosscutting Themes – Internet Technologies, Infrastructure, Services and Applications; Open Source Tools, Open Models and Architectures; Security, Privacy and Trust; Navigation Systems, Location Based Services; Social Networks and Online Communities; ICT Convergence, Digital Economy and Digital Divide, Neural Networks, Pattern Recognition, Computer Vision, Advanced Computing Architectures and New Programming Models, Visualization and Virtual Reality as Applied to Computational Science, Computer Architecture and Embedded Systems, Technology in Education, Theoretical Computer Science, Computing Ethics, Computing Practices & Applications

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